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ABSTRACT

This metric education curriculum guide, produced under the direction of the State of Louisiana Department of Public Education, was developed as part of a metrication plan approved by the Louisiana Board of Elementary and Secondary Education. This guide is designed to help teachers prepare students for the predominantly metric world in which they will live as adults. A "hands-on" approach appropriate to the maturity of the students is used throughout the guide, which covers grades K-12. The guide contains: (1) a roster of members of the metric curriculum writing team; (2) a list of metric program pilot teachers; (3) a brief history of the metric system; (4) four important aspects involved in the teaching of measurement; (5) some selected notes regarding the use of metric labels; and (6) objectives and activities collected under length and distance, area, capacity and volume, weight and mass, temperature, and time. This document concludes with an appendix that contains a teacher self-evaluation section, addresses of sources of free metric materials, and other metric-related topics, and a selected bibliography with suggested references. (MP)

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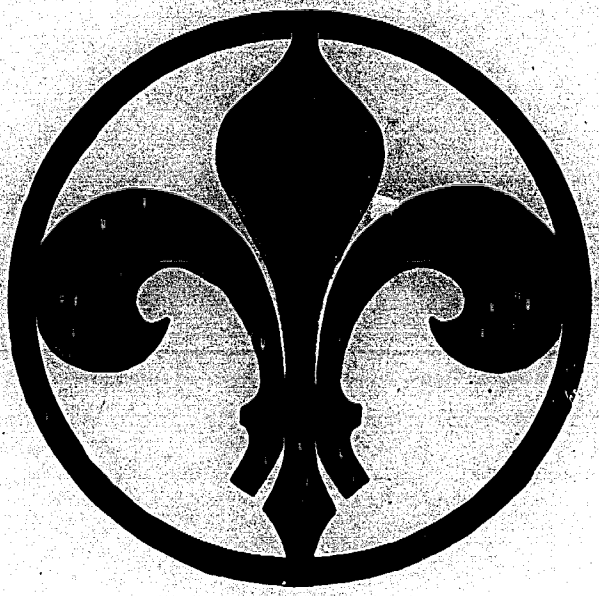
Metric Education Curriculum Guide

Grades K-12



Bulletin No. 1537

Louisiana Department of Education
J. Kelly Nix, State Superintendent

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DEPARTMENT OF PUBLIC EDUCATION
STATE OF LOUISIANA

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1979

METRIC EDUCATION CURRICULUM GUIDE

(K-12)

Issued by

Division of Academic Programs

J. KELLY NIX

State Superintendent

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from the U.S. Office of Education

FOREWORD

This curriculum guide was developed by a group of Louisiana teachers as part of a metrication plan approved by the Louisiana Board of Elementary and Secondary Education.

The guide is designed to help teachers to prepare students for the predominantly metric world in which they will live as adults. A "hands on" approach appropriate to the maturity of the students is used throughout the guide. This approach is ideal since students learn more through active involvement than through passive listening.

As business and industry place greater emphasis on the metric system of measurement, the educational community must do its share to help citizens to make a smooth transition from customary to metric measurement.

We hope that this guide with its wealth of activities will serve as a framework for the effective acquisition of skills in metric measurement for students in the public schools in Louisiana.

J. KELLY NIX

ACKNOWLEDGMENTS

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RATIONALE

A rational system of measurement is necessary for the proper functioning of our society. Measurement affects nearly everything we do. We make hundreds of measurements every day, beginning when we check our clocks to see if it is time to get up in the morning until we set our alarm before retiring at night. Measurement affects every transaction in trade and industry and it is as important to the housewife and laborer as it is to the scientist or the engineer.

The metric system of measurement is easy to use because of its simplicity and its consistency. John Adams, in his report to Congress in 1821, called it "the greatest invention of human ingenuity since printing." Since the metric system is based on decimals, it is easy to make conversions by simply moving the decimal point. People who are familiar with the metric system overwhelmingly agree that it is far superior to the standard of measurement now used. Once the public understands the metric system and learns how effectively it can be employed in every facet of American life, this system is certain to become the accepted system of measurement. General acceptance of this system, of course, depends to a great extent on a vigorous orientation campaign waged by educators dedicated to promoting the metric system as the accepted system of measurement in our schools, in our work, and in all areas of American life.

HISTORY OF THE METRIC SYSTEM

The metric system originated in France during the French Revolution when leaders recognized the need for a single, rational, coherent, and internationally accepted system of measurement.

In 1679 Gabriel Mouton, who is regarded as the founder of the metric system, proposed a decimal system of weights and measures. It was not until the latter part of the 18th century that the French National Assembly requested the French Academy of Science to work out a system of measurement suitable for international use. The French Academy developed a decimal system based on nature. The standard unit of length was the meter. The meter was equal to a portion of the earth's circumference. The measure of capacity (volume) and weight (mass) is derived from the unit of length, thus relating the basic units to each other. The system was both simple and scientific.

In 1875 the United States along with 16 other countries signed the "treaty of the meter," which provided for an International Bureau of Weights and Measures and a General Conference of Weights and Measures. As a result of the "treaty of the meter," metric standards were constructed and distributed to each nation.

As the number of countries adopting the metric system increased, the number of revisions increased and the system differed from country to country. In 1960, the General Conference of Weights and Measures adopted a single metric system of units. The name chosen for the system of units was Le System International d' Unites (International System of Units), with the international abbreviation SI.

The metric system did not receive serious attention in the United States until 1965 when Great Britian announced its intention to convert to the metric system over a 10-year period. A 3-year study was authorized by the Metric Study Act of 1968. The resultant report of the United States Metric Study, given by the Secretary of Commerce to Congress, concluded that it would be in the best interest of this nation to change to the predominant use of the metric system.

The Metric Conversion Act of 1975 was signed into law by President Gerald Ford, December 23, 1975. The two main provisions of this Act are:

1. It declares it to be the national policy to plan and to coordinate increasing use of the metric system in the United States, and
2. It creates a United States Metric Board to coordinate the conversions. No overall fixed period of time is specified for the changeover.

In Louisiana our commitment to metric education has been confirmed by Senate Concurrent Resolution No. 109 of 1972 and Senate Concurrent Resolution No. 27 of 1976.

1. PRE-MEASUREMENT SKILLS

A prerequisite skill for measuring is knowledge of the principle of conservation of length. A child cannot understand measurement if he thinks that a ruler lengthens as it is moved away from him. Once he understands conservation, he is ready to begin measuring with understanding.

A child should also be able to compare objects with each other before he begins the measurement process. Comparisons of things should begin at an early age and should grow increasingly complex as the learner develops skill in this area.

2. AN ACTIVITY APPROACH - ESTIMATION AND VERIFICATION

The best way to learn to think metric is through experiences with metric units. Educators agree that the "hands on" approach is the best way to learn measurement. The teacher should provide extensive practice in estimating and in checking measurement of familiar objects. Such experiences enable the learner to think in terms of the reasonableness of the results he obtains.

3. NO CONVERSIONS

In countries that have made the transition to the metric system, the overall consensus is that conversion among measurement systems should be avoided whenver possible. The method that the teacher uses in teaching the metric system can make the difference between students who are enthusiastic and those who are completely "turned off."

In cases where conversion is necessary, charts and tables that do not require the use of conversion formulas, but give simple comparison between units in the two systems, should be made available to the students.

Some approximate comparisons that are useful are:

A meter is a little longer than a yard.
A liter is a little larger than a quart.
A kilogram is a little heavier than two pounds.
An inch is about 2.5 centimeters.

4. METRIC - NOT A SEPARATE TOPIC

The teaching of the metric system should be an integral part of the mathematics program. It should be incorporated in the teaching of the measurement strand and should not be singled out as an entity in itself. All teachers should make a concerted effort to integrate the International System of Units throughout the curriculum and thus avoid the possibility of presenting the metric system as an isolated topic of study.

HOW TO USE THE GUIDE

The Metric Education Curriculum Guide is divided into six sections corresponding with six areas of measurement, length and distance, capacity and volume, weight and mass, temperature, and time. Each section contains two parts: learning objectives and activities designed to achieve each objective. In the learning objectives, asterisks are used to indicate the skills included in the Louisiana Minimum Standards for Mathematics, Grades 1-12. Three asterisks are used to indicate the grade level at which the skills are to be mastered according to the minimum standards.

Example: According to the Louisiana Minimum Standards for Mathematics, Grades 1-12, objective 11 on page 7 should be mastered by the end of the third grade.

The heavy black line begins at the grade in which the skills should be introduced and ends at the grade in which mastery is desired. The broken line indicates maintenance of the skills.

For easy reference, each learning objective is restated before the appropriate activity in the activities section with introduction and maintenance levels indicated.

Example: Objective 1 on page 7 is restated before activity 1 on page 14.

The solid line indicates that the skill should be introduced in first grade and mastered by the end of the fourth grade. The broken line indicates maintenance.

The activities presented in this guide are sample activities which have been used by members of the writing committee and the pilot teachers. Teachers are encouraged to create additional activities and/or substitute activities that they deem more appropriate to the needs of their students.

METRIC NOTES

1. All SI prefixes are accented on the first syllable, so kilometer (km) is accented on the FIRST syllable. Unfortunately, most of the nation's radio and TV news commentators have been saying kiLOMeter.

2. The base unit of mass is the kilogram, but prefixes are applied to the gram rather than the kilogram.

3. Symbols are always written in lower case letters, except when the unit name is derived from a proper name. (Examples: m for meter, s for second, but C for Celsius; exception L for liter.)

4. A symbol is never followed by a period except at the end of a sentence.

5. Symbols are never pluralized.

6. A full space is used between the numeral and the symbol (45 g not 45g).

7. Use decimal fractions, not common fractions (0.25 g, not ¼g).

8. Use a zero before the decimal point in any decimal less than one (0.25 g, not .25 g).

9. Use spaces instead of commas to separate numbers of five digits or more with respect to the decimal point - (25 627 not 25,627 - 503.165 723 not 503.165723).

10. The American National Metric Council recommends the "er" spelling for meter and liter.

11. Conversions between measurement systems should be avoided where possible.

12. The product of two or more symbolized units is indicated by a centered dot between the symbols (kg·m). The dot is raised to distinguish it from a decimal point.

13 The symbol (ℓ) for liter has been replaced by the upper case letter (L).

14. The word "mass" is used in preference to the word "weight." In common practice the word weight means either mass or force. In the SI Units, kilograms measure "mass" while Newtons measure "force."

15. Units of area and volume must be written with an exponent 2 and 3 respectively m^2, km^2, m^3, cm^3, (c c is incorrect).

16. In spoken English, it is advisable to use the expression "metric ton" in place of "tonne". In writing, it is unnecessary to use the adjective "metric" to modify the word "tonne".

17. The degree symbol is not used with the K for kelvin. A temperature such as 250K is read as "250 kelvins".

LENGTH AND DISTANCE	K	1	2	3	4	5	6	7	8	9	10
* (1) Identify objects of the same length and objects of different lengths.	***										
* (2) Identify the taller and shorter of two concrete objects.	***										
(3) Describe the locations of two concrete objects as near or far.											
(4) Distinguish differences in lengths using direct comparison (longer and shorter).											
(5) Make oral statements about the length of an object.											
(6) Identify objects that are longer or shorter than a given concrete object.											
(7) Measure the length of an object using as many uniform size pencils, straws, etc., laid end-to-end as necessary.											
(8) Measure the length of an object using a non-standard unit such as a single pencil, straw, etc.											
(9) Measure the lengths of many different objects using several non-standard units.											
(10) Make written statements about the length of an object. after measuring with like objects of unequal lengths.											
*(11) Identify the centimeter and meter as units of metric linear measure.					***						

mum Standard

LENGTH AND DISTANCE	K	1	2	3	4	5	6	7	8	9	10
*(12) Measure lengths using the centimeter.				***							
*(13) Measure lengths using the meter.					***						
(14) Measure a line segment or object to the nearest meter using a meter stick.											
(15) Mark off a given length using centimeter unit strips or blocks as a standard unit of measure.											
(16) Measure a line segment or object to the nearest centimeter using a centimeter ruler.											
(17) Measure longer distances using the trundle wheel.											
(18) Choose an appropriate metric unit (meter or centimeter) to measure the length of an object.											
(19) Estimate the length of an object in centimeters.											
(20) Identify the decimeter as a unit of linear measure.											
(21) Measure the length of an object to the nearest decimeter using decimeter rods or ruler marked in decimeter bands.											
(22) Demonstrate that 100 centimeters is equivalent to 1 meter, 10 centimeters is equivalent to 1 decimeter, 10 decimeters is equivalent to 1 meter.											

LENGTH AND DISTANCE	K	1	2	3	4	5	6	7	8	9	10
3) Identify perimeter and determine the perimeter of a polygon by counting the units along each of the sides of a two dimensional figure.				■	■	■	- -	- -	- -	- -	- -
4) Estimate and determine lengths to the nearest meter.				■	■	■	■	■	- -	- -	- -
5) Estimate and determine lengths to the nearest decimeter.				■	■	■	■	■	■	- -	- -
6) Choose the appropriate metric measure to determine the length of an object (centimeter, decimeter, meter).				■	■	■	■	■	■	- -	- -
7) Recognize and use the appropriate symbols for meter (m), decimeter (dm) and centimeter (cm).				■	■	■	■	■	- -	- -	- -
8) Convert linear measures from centimeters to meters, meters to centimeters. (Note: At grades 3 and 4 no decimals should be required.) May be extended to include the decimeter.					■	■	■	■	■	***	- -
9) Relate metric units of length of familiar objects, including body parts (meter, decimeter, centimeter).				■	■	■	■	■	- -	- -	- -
30) Draw line segments of specified lengths.			■	■	■	■	■	■	- -	- -	- -
31) Add and subtract like whole metric units.					■	■	■	■	- -	- -	- -
32) Identify and use the dekameter, hectometer and kilometer as units of linear measure.					■	■	■	■	■	■	- -
33) Recognize and use the appropriate symbols for dekameter (dam), hectometer (hm) and kilometer (km).					■	■	■	■	■	- -	- -

Minimum Standard

LENGTH AND DISTANCE	K	1	2	3	4	5	6	7	8	9	10
(34) Interpret map scales which use metric measure.					———	———	———	———	———	———	- -
(35) Identify and use the millimeter as a unit of linear measure to determine the length of a given object.						———	———	———	———	- - -	- -
(36) Recognize and use the appropriate symbol for millimeter (mm).						———	———	———	———	- - -	- -
(37) Convert to meters a measure given in kilometers, hectometers to meters, dekameters to meters.						———	———	———	———	- - -	- -
(38) Convert to millimeters a measure given in centimeters.						———	———	———	———	- - -	- -
(39) Convert to meters a measure given in decimeters or centimeters.						———	———	———	———	- - -	- -
(40) Choose the appropriate metric measure to determine the length of an object or the distance between two points (extend to include millimeter and kilometer).						———	———	———	———	———	———
(41) Associate metric prefixing with the place-value structure of the decimal system.							———	———	———	———	———
(42) Rename a given measure of length using different metric units.							———	———	———	———	———
(43) Round off a measure given in millimeters to the nearest centimeter or meter, given in centimeters to the nearest meter.							———	———	———	———	———
*(44) Add and subtract unlike metric units.							———	———	———	———	***

* Standard

LENGTH AND DISTANCE	K	1	2	3	4	5	6	7	8	9	10
(45) Multiply a metric unit by a constant, divide a metric unit by a constant and divide like whole metric units.											
(46) Demonstrate proficiency in the selection and use of measurement equipment.											
(47) Identify the micrometer (μm) and the megameter (Mm) as metric units of length and recognize their symbols.											
*(48) Determine the most appropriate metric unit to measure length.										***	
(49) Use decimals to show the relationship among micrometers, millimeters, centimeters, decimeters, meters, dekameters, hectometers, kilometers and megameters.											
(50) Use scientific notation (powers of 10) to make conversions within the metric system.											
(51) Measure the length of an object, to the nearest metric unit indicated, using a micrometer or a caliper as a measuring device.											
(52) Determine the greatest possible error in a reported measure.											
(53) Compare the precision of two measurements.											
(54) Convert linear measures within the metric system (include all 9 units).											
(55) Add, subtract, multiply and divide metric units.											

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* Minimum Standard

LENGTH AND DISTANCE	K	1	2	3	4	5	6	7	8	9	10
(56) Determine the perimeter of a geometric figure by actual measurement in metric units.						■	■	■	■	■	■
* (57) Use formulas to compute the circumference of a circle.						■	■	■	■	***	

LENGTH AND DISTANCE

* 1. Objective — Identify objects of the same length and objects of different lengths.

Material(s): String, strips of tag board, etc.

Sample Activity: The student will locate and describe objects in the classroom of the same length and objects of different lengths.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* 2. Objective: Identify the taller and shorter of two concrete objects.

Material(s): Glasses, hats, lamps, jars

Sample Activity: The teacher will place two objects side by side. The student will determine which one is taller and which one is shorter.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

3. Objective: Describe the relative locations of two concrete objects as near and far.

Material(s): A collection of various objects such as chairs, trash cans, string, etc.

Sample Activity: The students will determine which of two objects, such as two chairs, is nearer to them and determine which of two objects, such as two chairs, is farther from them.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

4. Objective: Distinguish differences in lengths using direct comparison (longer and shorter).

Material(s): Objects of varying lengths such as pencils, nails, straws, crayons, spoons, scissors, paint brushes, paper clips and yarn loops. Tag board cards with "longer" and "shorter" printed on them.

Sample Activity: The teacher will arrange a number of yarn loops on a table, have a student place a pair of objects into each loop, ask the student to compare the lengths of two objects in each loop and label the shorter or longer of the two objects with a tag board card that has

"shorter" or "longer" printed on it. Students can distinguish large differences in length much more easily than small differences. The teacher may increase the level of difficulty of this task by introducing cards with the word "same" printed on them and by providing objects for the activity that are the same length.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

5. Objective: Make oral statements about the length of an object.

Material(s): Enough objects for each student to hold one

Sample Activity: The students will sit in a circle. One student is "it." The student who is "it" goes to a student and holds up his object. The student in the circle holds up his object and makes an appropriate statement such as, "My pencil is longer than your crayon." If the student makes an incorrect statement, he becomes "it."

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

6. Objective: Identify objects that are longer or shorter than a given concrete object.

Material(s): Two yarn loops (one labeled "shorter than" and the other labeled "longer than") and a collection of objects of varying lengths such as straws, paper clips, crayons, etc.

Sample Activity: The teacher will place one object such as the straw or a pencil between the two yarn loops. The other objects are sorted into the appropriate yarn loop.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

7. Objective: Measure the length of an object using as many uniform size pencils, straws, etc., laid end-to-end as necessary.

Material(s): Clothespins, pencils, desk top, door (width of), book, etc., record sheet

Sample Activity: The student will use a bag of pencils and a record sheet on which he will list the things to be measured. He will estimate the length of each object and build a long train of pencils to verify his guesses. He will record his estimates and measures on the record sheet (sample).

Estimated Lengths in Pencils	Object	Number of Pencils in Length

15

Grades: K, 1, 2, 3, 4, 5, 6, 7, 9, 9, 10

8. Objective: Measure the length of an object using a non-standard unit such as a single pencil, straw, etc.

Material(s): Drinking straws, pencils, items to measure such as a hammer, jump rope, baseball bat, broom, record sheet

Sample Activity: One student will make a list of things which he may measure by using drinking straws or pencils laid end-to-end. Other students will add items to the list which they wish to measure. The student will make his best guess on the number of straws that will equal the length of each object before he measures its length. Student will use a record sheet like the following one to indicate the results of the activity. The student will take the actual measurement of each object using a single pencil, straw, etc.

Estimated Lengths (in straws)	Object	Measured Length (in straws)
	jump rope baseball bat hammer broom chalk tray piano	

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

9. Objegtive: Measure the lengths of many different objects using several non-standard units.

Material(s): Tempera paint or finger paint, paint brushes, newsprint, paint smocks

Sample Activity: The teacher will give each student newsprint on which to make handprints. The teacher will explain that each print must touch the others because he is making a handprint ruler. The teacher should help the students to develop a list of items which each will measure.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

10. Objective: Make written statements about the length of an object after measuring with it like objects of unequal lengths.

Material(s): Straws, envelopes, books, 12-15 roasted peanuts for each pair of students, record sheet on which student will have a place to write out statements about length.

Sample Activity: The students will work in pairs and use a record sheet and about 12-15 peanuts. One partner guesses the lengths of the objects suggested on the activity sheet, using peanuts as the unit of measurement. The other records the lengths on the record sheet. Students may compare answers and discuss reasons for any differences.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*11. Objective: Identify the centimeter and meter as units of metric linear measure.

Material(s): Meter stick, plastic cups, a collection of objects such as keys, candy, button, rocks, nuts, etc.

Sample Activity: The teacher will provide students with familiar objects which have lengths of 5 cm or less. The teacher will have students sort the objects by size into plastic cups which are marked 1, 2, 3, 4 and 5 centimeters. The teacher will check with the students to see which objects are closest to the lengths indicated.

Sample Activity: The student will use a meter stick to locate a place on his body that is one meter above the floor. He will check for "feel" of a meter by estimating a distance of one meter between his hands. Other student partners should check the estimation for accuracy.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*12. Objective: Measure lengths using the centimeter.

Sample Activity: Have students make their own rulers up to 30 centimeters(3dm).

Material(s): Metric rulers, a collection of objects such as beans, buttons, markers, decimeter rods marked in centimeters

Sample Activity: The teacher will assign two students to play this game. They will take turns building a train using buttons, beans, etc. The object of the game is to see who can correctly estimate the length of the other's train in centimeters. The students will measure the train to check their estimates.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*13. Objective: Measure lengths using the meter.

Material(s): Blank plastic tape cut into meter lengths, miscellaneous objects close to a meter in length, record sheets, pencils

Sample Activity: The teacher will give each student a piece of blank plastic tape that has been cut into meter lengths. He will look about the room or playground to find as many objects as he can which he thinks are nearly the same length as the tape. He will list the names of the objects on a record sheet in columns labeled "less than one meter," "about one meter" and "more than one meter." The student will measure to verify correctness of listing.

es:	K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
ctive:	Measure a line segment or object to the nearest meter using a meter stick.
rial(s):	Blank meter sticks or meter length tape
le vity:	The teacher will select various objects on the playground or in the room which are not of whole meter lengths. Using the blank sticks or tapes, the student will measure the length and state each in whole meter lengths. As this necessitates rounding to the nearest meter (half or more moves to the next larger meter), the student should explain his measures.
es:	K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
ctive:	Mark off a given length using centimeter unit strips or blocks as a standard unit of measure.
rial(s):	Blank paper such as art paper, centimeter cubes, strips, etc.
le vity:	The teacher will direct each student to draw a picture in which a specific line segment is required such as a bug with 1-cm feelers, a flag with a 7-cm pole.
es:	K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
ctive:	Measure a line segment or object to the nearest centimeter using a centimeter ruler.
rial(s):	Centimeter ruler, blank chart, any 10 small objects, a record sheet
le vity:	The teacher will place 10 objects on a table. The teacher will make a chart on which to record the objects, the estimated (guessed) length of each and the measured length. The students will estimate and, using the centimeter ruler, measure for accuracy and record their measures on the record sheet. Only whole centimeter units should be recorded. This necessitates rounding to the nearest centimeter (half or more moves to the next larger number of units).
es:	K, 1, 2, 3, 4, 5, 6, 7, 8, 9. 10
Standard	

17. Objective: Measure larger distances using the trundle wheel.

Material(s): A trundle wheel

Sample Activity: The teacher will explain to the students that "to trundle" means to "roll along." The students will roll the wheel along to measure larger distances such as the length of a field, the width of a room, etc.

A. Place the wheel on its side on the floor.
Wrap the tape around the outside of the wheel.
How far is it around the outside of the wheel? (1 meter)

B. The wheel moves one meter every time it makes a full turn. There is an easy way to measure things to the nearest meter when you know how to "set" the wheel. To "set" the wheel, you should:

1. Roll the wheel along the floor until it makes a loud "click."
2. Roll the wheel back toward you until it will no longer turn.
This is called its jammed position.
3. While keeping the wheel jammed, turn the trundle wheel so that the START arrow points to the floor.

C. The wheel is set. Now roll the wheel forward. Each time it clicks, you will have moved one meter.

D. Set the wheel against a wall of your room to the nearest meter -- that is, to the nearest full turn of the wheel. Determine the width of the room to the nearest meter.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

18. Objective: Choose an appropriate metric unit (meter or centimeter) to measure the length of an object.

Material(s): A list of objects or distances familiar to the students

Sample Activity: The students will sort the list into two lists under the headings: "Best measured in centimeters" and "Best measured in meters."

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Objective: Estimate the length of an object in centimeters.

Material(s): A collection of classroom objects

Sample Activity: The teacher will divide the class into two teams. The first player from team "A" is asked to estimate the length of an object such as a chalkboard eraser. After the estimate is stated the first player on team "B" measures the length. Any discrepancy between estimate and true measure is recorded for the team score - perfect score on any round is 0. The second player on team "B" is then asked to estimate a length and the second player on team "A" measures. Play continues with alternating turns until all players have had a chance to estimate and to measure. The team having the lower score is the winner.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Objective: Identify the decimeter as a unit of linear measure.

Material(s): Metric rulers marked in decimeters, or orange cuisenaire rods, string, soda straws (enough for each student to cut 10 decimeter lengths).

Sample Activity: The student will use decimeter lengths to discover the relationship of the decimeter to the meter and to the centimeter. The student will identify familiar objects or body parts about a decimeter in length. The student will cut straws into decimeter lengths and string 10 of them together to form a "fold-up" meter. He can use this to measure objects to the nearest decimeter.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Objective: Measure the length of an object to the nearest decimeter using decimeter rods or a ruler marked in decimeter bands.

Material(s): A collection of objects such as beans, buttons, markers, decimeter rods, ruler marked in decimeter bands

Sample Activity: The students will play the game "Estimation." "Estimation" is a game which is played by two students. The students will take turns building a train using buttons, beans, etc. The object of the game is to see who can best estimate the length of the other's train in decimeters. Verify correctness by measuring.

Scoring Points: Give 5 points for a correct guess and 3 points for a guess that is within 1 decimeter of the actual measure.

Winner: The first person to accumulate 21 or more points.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

22. Objective: Demonstrate that 100 centimeters is equivalent to 1 meter, that 10 centimeters is equivalent to 1 decimeter, that 10 decimeters is equivalent to 1 meter.

Material(s): Meter stick, 100 1-centimeter cubes, 10 unmarked 10-centimeter rods (decimeter rods)

Sample Activity: The students will perform the following steps:

1. Use 10-cm rods laid end-to-end to compare the total length to a meter.
2. Use 1-cm rods to compare with 10-cm rod (decimeter).
3. Use 1-cm rods to compare with meter.

NOTE: The teacher will check to determine if the student understands the relationships developed. Other activities should be developed to help the student refine these units.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*23. Objective: Identify perimeter and determine the perimeter of a polygon by counting the units along each of the sides of a two dimensional figure.

Material(s): Cut outs of straight-sided figures with whole centimeter length sides (label the figures with letters for easy identification), metric rulers marked in centimeters, or centimeter rods

Sample Activity: The student will measure and record the lengths of the outside edges of figures. Results should be recorded in statements such as, "The perimeter of figure A is 22 centimeters."

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*Minimum Standard

24. Objective: Estimate and determine lengths to the nearest meter.

Material(s): Meter stick and/or metric tape, worksheet

Sample Activity: The student will estimate and measure the dimensions of the classroom and height of the doorknob above the floor and record estimates and measurements on a worksheet.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

25. Objective: Estimate and determine lengths to the nearest decimeter.

Material(s): Meter stick and/or meter tape, construction paper

Sample Activity: The student will measure and cut construction paper into decimeter length strips and will tape 10 of these together to form a meter tape. The student will make a list of objects to measure. He will estimate the length of each object and use the tape to measure to the nearest decimeter.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

26. Objective: Choose the appropriate metric measure to determine the length of an object (centimeter, decimeter, meter).

Material(s): Meter stick, tape, or ruler

Sample Activity: While measuring objects in the classroom (examples: eraser on a pencil, length of a pencil, length of an index card, length of a windowpane, a friend's height, length of the classroom), the student will use the inquiry method to determine the most appropriate unit of measure for each.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

27. Objective: Recognize and use the appropriate symbols for meter (m), decimeter (dm), and centimeter (cm).

Material(s): Textbook and/or teacher-made chart

Sample Activity: The teacher will show students how symbols are derived - meter (m), decimeter (dm), and centimeter (cm) and will use these symbols when giving measurements of classroom or sports objects. The teacher should emphasize that they are symbols rather than abbreviations and do not take periods. The teacher may compare with the chemical symbols such as H for hydrogen and point out that there is no period after the symbol.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*28. Objective: Convert linear measures from centimeters to meters, meters to centimeters. (Note: At grades 3 and 4 no decimals should be required.) May be extended to include the decimeter.

Material(s): Cards with pairs of equivalents such as 200 centimeters on one and 2 meters on another using only multiples of equivalents: 100 cm = 1 m, 10 cm = 1 dm, 10 dm = 1 m.

Sample Activity: The students will place cards face down in an arrangement of even columns and rows. Taking turns players try to match terms and symbols in a Concentration-style game. The first player turns over two cards so all players can see. If they match, he takes the pair and plays again. If they do not match, he turns them face down in the same position they were in originally. The second player then turns over a card so everyone can see. He tries to select a card he thinks will match (remembering the cards he has seen previously). The player who matches the most pairs is the winner.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

29. Objective: Relate metric units of length to familiar objects, including body parts (meter, decimeter, centimeter).

Material(s): Metric tape or ruler, objects in classroom

Sample Activity: The students will measure and determine the approximate equivalents so that they will have a "ready reference ": thickness of finger = 1 cm, length of palm = 1 dm, tip of nose to outstretched arm = 1 m.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

30. Objective: Draw line segments of specified lengths.

Material(s): Metric tape or ruler, paper, chalkboard

* Minimum Standard

Sample Activity: The student will draw a flower with a stem measuring 6 cm; a house measuring 1 dm across the base; a hop-scotch diagram 3 m long.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

31. Objective: Add and subtract like whole metric units.

Material(s): Textbook and/or teacher-made activity sheet

Example for activity sheet:

10 cm + 5 cm = 15 cm
30 dm - 17 dm = 13 dm

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

32. Objective: Recognize and use the appropriate symbols for dekameter (dam), hectometer (hm), and kilometer (km).

Material(s): Teacher-made chart

Sample Activity: The student will match the metric unit to the correct symbol.

1. dekameter	a. hm
2. hectometer	b. km
3. kilometer	c. dam

Other symbols known at this time could also be included.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

33. Objective: Identify and use the dekameter, hectometer, and kilometer as units of linear measure.

Material(s): Large open area, city and/or state maps

Sample Activity: Using a cord 1 dam long (10 meters), students will measure this distance in a large open area. Using 10-dam cords to construct a 1 hm length, students will measure this

distance in a large open area. Using the hm cord to measure 10 hm, students will walk this distance to show that 10 hm = 1 km. (Maps will be used to indicate distances between cities which will be expressed in km.)

Note to Teacher: dam and hm are used to show how km is derived and give concrete experiences to develop the concept of the km.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

34. Objective: Interpret map scales which use metric measure. See Bibliography for addresses for metric maps.

Material(s): Factory-made maps, teacher-made maps drawn to scale

Sample Activity: The student will determine distance from one point to another; e.g., distances between cities.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

35. Objective: Identify and use the millimeter as a unit of linear measure to determine the length of a given object.

Material(s): Paper clip

Sample Activity: The student will straighten a paper clip, measure the diameter (thickness) of the wire and measure the length of the wire in mm.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

36. Objective: Recognize and use the appropriate symbol for millimeter (mm).

Material(s): Textbook and/or teacher-made chart, cards

Sample Activity: See the activities suggested for objectives #27 and #33 for ideas which can be extended to include the millimeter.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

37. Objective: Convert a measure given in kilometers to meters; hectometers to meters; dekameters to meters.

Material(s): Teacher-made chart: 1 km = 1000 m
1 hm = 100 m
1 dam = 10 m
and a prepared worksheet for students to complete

Sample Activity: The student will use the teacher-made chart for reference as needed to complete equations such as: 5 km = 5000 m
2 hm = 300 m
8 dam = 80 m

This activity can be extended to completion of statements, such as ___ km = 2000 m, in which no decimal is needed; or 7 ___ = 70 m, in which student supplies the unit name.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

38. Objective: Convert a measure given in centimeters to millimeters.

Material(s): Worksheet similar to the one described for objective #37

Sample Activity: The student will complete statements such as 4 cm = ____ mm. This can later be extended to statements such as ___ cm = 50 mm, in which no decimal is needed; or 3 cm = 30 ___, in which student supplies the unit name. These activities can be mixed on a sheet with items from objective #37.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

39. Objective: Convert a measure given in decimeters or centimeters to meters (implies place value and use of decimals).

Material(s): About 20 cards with lengths equal to 3 meters or less stated in decimeters or centimeters (for example - 17 dm or 352 cm), an answer key with lengths shown as stated on cards and the equivalent as stated in meters (for example - 17 dm = 1.7 m), paper and pencil

Note: Unit names or symbols may be used.

Sample Activity: The teacher will assign two or three students to work together. In turns, student will draw a card, convert the measure from the one given to its equivalent in meters and record his answers. After each turn, a student adds the new answer to the sum of answers given on previous turns. The first player to get a total of ten meters or more is the winner.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

40. Objective: Choose the appropriate metric measure to determine the length of an object or the distance between two points (extend to include millimeter and kilometer).

Material(s): Textbook and/or teacher-made worksheet with activities similar to the one described below

Sample Activity: The student will indicate the appropriate metric measure to describe the approximate length of each of the following:

Diameter of the wire in a paper clip = mm
Thickness of finger = cm
Length of new piece of chalk = dm
Width of a twin bed = m
Approximate width of volleyball court = dam
Football field plus one end zone = hm
Distance in city = km

Note: Emphasis should be placed on millimeter, centimeter, meter and kilometer. Also, the others should be de-emphasized.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

41. Objective: Associate metric prefixing with the place value structure of the decimal system.

Material(s): Teacher-made worksheet

Sample Activity: The student will match each metric prefix with the correct place value.

1. 0.001	a. deci
2. 0.01	b. milli
3. 0.1	c. hecto
4. 10	d. centi
5. 100	e. kilo
6. 1000	f. deka

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

42. Objective: Rename a given measure of length using different metric units.

Material(s): Textbook and/or teacher-made chart, meter stick or meter tape

Sample Activity: Measure the length of each object and rename it three times using a different unit each time, as shown in the table below.

	m	dm	cm	mm
Length of table	____	____	____	____
Height of doorframe	____	____	____	____
Length of chalkboard	____	____	____	____

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

43. Objective: Round a measure given in millimeters to the nearest centimeter or meter; given in centimeters, to the nearest meter.

Material(s): Teacher-made worksheet

Sample Activity: The student will fill in the chart rounding mm measures to the nearest cm.

22 mm = 2 cm
28 mm = 3 cm
76 mm = 8 cm

Similar exercises can be constructed for rounding mm to m (1157 mm = 1 m) and cm to m (589 cm = 6 m).

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*44. Objective: Add and subtract unlike metric units.

Material(s): Textbook and/or teacher-made worksheet

* Minimum Standard

Sample Activity: The student will compute the solutions to problems similar to those given below.

1 m + 2 dm + 3 cm = 123 cm
2 m + 4 dm + 7 cm = 2.47 m
3 m + 3 dm + 5 cm = 3 350 mm

2 dm - 3 cm = 20 cm - 3 cm = 17 cm
5 m - 4 dm = 50 dm - 4 dm = 46 dm
or 500 cm - 40 cm = 460 cm

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

45. Objective: Multiply a metric unit by a constant, divide a metric unit by a constant and divide like whole metric units.

Material(s): Textbook and/or teacher-made worksheet

Sample Activity: The student will compute the solutions to problems similar to those given below.

Multiply 2 cm x 9 = 18 cm
352 x 12 m = 4 224 m

Divide 12 mm ÷ 3 mm = 4
36 m ÷ 9 m = 4
21 cm ÷ 7 = 3 cm

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

46. Objective: Demonstrate proficiency in the selection and use of measurement equipment.

Material(s): Meter stick, tape, ruler, trundle wheel, etc.; list of objects or distances which can be measured by the student

Sample Activity: The student will be given a list similar to the one in the following chart. The student will select a measuring device and measure the indicated item. Both the name of the instrument and the measurement should be recorded.

What to Measure	Equipment Used	Measurement
Length of a paper clip		
Length of a book		
Length of a piece of cloth		
Classroom door to back of room		
Length of sidewalk in front of building		
Circumference of a trash can		

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

47. Objective: Identify the micrometer (pronounced mi-cro-me'-ter) and the megameter as metric units of length and recognize their symbols.

Note: The instrument used for measuring very small distances is the micrometer (pronounced mi crom' eter). In pronouncing the units kilometer and micrometer, the accent is placed on the prefixes. Sometimes the unit of length is spelled m-i-c-r-o-m-e-t-r-e to distinguish it from the instrument.

Material(s): Cards with metric unit names including micrometer and megameter and cards with symbols for the units. (μm is used for micrometer and Mm is used for megameter.) A total of 20 cards is desirable.

Sample Activity: The students will play a Concentration-style game as described in the activity of objective 28.

Material(s): Cards with pairs of simple equivalents such as 1 meter on one card and 1 000 000 um on another, a total of 20 cards is desirable (include the micrometer and megameter in some of the pairs)

Sample Activity: The students will play a Concentration-style game as described in the activity of objective 28, matching equivalents.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*48. Objective: Determine the most appropriate metric unit to measure length.

Material(s): Prepared worksheet

Sample Activity: Given a list of lengths and distances, the student will name an appropriate unit for measuring each.

Example: Distance from earth to moon, length of football field, person's height, length of pencil, thickness of a hair, thickness of a sheet of paper.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

49. Objective: Use decimals to show the relationships among micrometers, millimeters, centimeters, decimeters, meters, dekameters, hectometers, kilometers, and megameters.

Material(s): A die labeled with the symbols for any 6 of the 9 units -- micrometer, millimeter, centimeter, decimeter, meter, dekameter, hectometer, kilometer, and megamete: a prepared sheet similar to the following:

Mm	km	hm	dam	m	dm	cm	mm	um

Sample Activity: The student will roll the die. The symbol that appears is the reference unit. Place a 1 in the appropriate column and fill in the remaining spaces in the row.

* Minimum Standard

Mm	km	hm	dam	m	dm	cm	mm	µm
0.000 000 01	0.000 01	0.0001	0.001	0.01	0.1	*1.0	10	10 000
.000 1	0.1	**1.0	10	100	1 000	10 000	100 000	100 000 000

* Centimeter was rolled
** Hectometer was rolled

Note: A second die can be used with whole numbers 1-6 on the sides. If a 2 is rolled the student writes 2.0 in the cm position and works from there.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

50. Objective: Use scientific notation (powers of 10) to make conversions within the metric system.

Material(s): Two 1-centimeter cubes, one labeled with the symbols for any 6 of the 9 units - micrometer, millimeter, centimeter, decimeter, meter, dekameter, hectometer, kilometer, and megameter, the other labeled with 10^0, 10^1, 10^2, 10^3, 10^4, 10^5; a prepared sheet similar to the following:

Mm	km	hm	dam	m	dm	cm	mm	µm

Sample Activity: The student rolls the dice. The symbol that appears is the reference unit; the exponent that appears is the exponent that is written in the chart under the unit.

Example: 10^3 and cm were rolled

Mm	km	hm	dam	m	dm	cm	mm	m
10^{-5}	10^{-2}	10^{-1}	10^0	10^1	10^2	10^3	10^4	10^7
or	or	or						
$\frac{1}{10^5}$	$\frac{1}{10^2}$	$\frac{1}{10^1}$						

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

51. Objective: Measure the length of an object, to the nearest metric unit indicated, using a micrometer (pronounced mi-crom'-e-ter) or a caliper as a measuring device.

Material(s): Various objects to be measured (wire, rims of glasses, coins, etc.), caliper, and micrometer

Sample Activity: The student will compare the thicknesses of red, brown, blonde, and black hair using a micrometer. Compare the thicknesses of a new coin and an old coin of the same denomination.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

52. Objective: Determine the greatest possible error in a reported measure.

Material(s): A prepared sheet with various metric measures and the formula for determining the greatest possible error

Sample Activity: Given a list of metric measures, the student will determine the greatest possible errors for each.

Formula: Divide the place value of the last significant digit by 2.

Example: 23.7 cm
GPE = 0.05 cm

$$\frac{0.1 \text{ cm}}{2} = 0.05 \text{ cm}$$

The place value of the last significant figure is tenths.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

53. Objective: Compare the precisions of two measurements.

Material(s): A prepared sheet

More precise - the measurement with the smaller greatest possible error

Sample Activity: Given pairs of metric measurements, the student will determine the one which is more precise.

		GPE
Example: #1	9.5 mm	0.05 mm
#2	9.50 mm	0.005 mm

Therefore #2 is the more precise measurement.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

54. Objective: Convert linear measures within the metric system (include all 9 units).

Material(s): A prepared sheet

Sample Activity: Given Column A with metric measure and Column B with the metric unit to be converted to, the student will write the equivalent of the given measure.

Example:	Column A	Column B
1.	53 cm	_____ m
2.	185 km	_____ dam

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

55. Objective: Add, subtract, multiply, and divide metric units.

Material(s): A prepared sheet

Sample Activity: Given problems involving all operations with like and unlike units, the students will convert if necessary and compute the answers.

Example:	32 cm	367 m	42
	+ 5 mm	- 2 mm	x 3 mm
	☐ cm	☐ m	☐ dam

How many boards 12 cm long can be cut from a board 9 m long?

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

56. Objective: Determine the perimeter of a geometric figure by actual measurement in metric units.

Material(s): Various measuring devices (meter sticks, meter tapes, centimeter tapes, etc.), various objects (desk top, book, paper plate, coins, etc.)
P = sum of all the sides or $S_1 + S_2 + S_3$, etc.

Sample Activity: The student will choose the appropriate measuring device and will measure a given object.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*57. Objective: Use formulas to compute the circumference of a circle.

Material(s): Prepared sheets using the formulas:

$C = 2\pi r$ or πd

Sample Activity: Given a prepared sheet with drawings of geometric figures and their dimensions, the student will compute the perimeters or circumferences, using the appropriate formula.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* Minimum Standard

AREA	K	1	2	3	4	5	6	7	8	9	10
(1) Compare (as larger or smaller) the areas of two surfaces.											
(2) Order the surfaces of three or more regions.											
(3) Use non-standard units (counters, dominoes, markers, etc.) to cover an irregular region.											
(4) Determine the number of non-standard units needed to cover an irregular region.											
(5) Make statements describing areas.											
(6) Use the term "area" to describe the amount of surface of an object.											
(7) Estimate the number of non-standard units needed to cover an irregular region.											
(8) Identify the square centimeter as a unit for measuring area.											
*(9) Measure, by counting in square centimeters, the area of a region.					***						
(10) Estimate the area of a small region in square centimeters.											
(11) Identify the square decimeter as a unit for measuring area.											

Minimum Standard

AREA	K	1	2	3	4	5	6	7	8	9	10
easure, by counting in square decimeters, the area of a region											
stimate in square decimeters the areas of figures larger than square decimeter.											
dentify the square meter as a unit for measuring area.											
easure, by counting in square meters, the area of a region.											
Estimate, in square meters, the areas of regions larger than square meter.											
Use the symbol cm^2 for square centimeter, dm^2 for square decimeter, m^2 for square meter.											
Demonstrate the relationship of the dm^2 to the m^2 (using models of units); the cm^2 to the dm^2; the cm^2 to the m^2.											
Determine the areas of rectangles (including squares) by multiplying and use the formula A = LxW.							***				
Determine the areas of polygons in metric units using standard formulas -- Rectangle: A=LxW; Parallelogram: A=BxH; Triangle: A=½BxH.										***	
Identify the are[1] (square dekameter), hectare (square hectometer), and square kilometer as metric units for measuring area.											
Identify the square millimeter as a unit for measuring small areas.											

m Standard

AREA	K	1	2	3	4	5	6	7	8	9	10
(23) Use the symbols: a for are, ha for hectare, km^2 for square kilometer, mm^2 for square millimeter.							▬	▬	▬	▬	▬
(24) Choose the most appropriate metric unit for measuring a given surface.							▬	▬	▬	- - -	- - -
*(25) Determine the area of a circle in metric units using the standard formula $A=\pi r^2$.							▬	▬	▬	***	▬
(26) Determine the surface area of a rectangular prism (cube, box, etc.).							▬	▬	▬	▬	▬
*(27) Convert square measures within the metric system (e.g., m^2 to cm^2, cm^2 to mm^2, m^2 to mm^2, mm^2 to m^2).							▬	▬	▬	▬	***
(28) Compute total surface area of any given geometric solid (prism, cone and sphere).						▬	▬	▬	▬	▬	▬
(29) Determine the area of a trapezoid, using the formula $\frac{1}{2}H(B_1+B_2)$.						▬	▬	▬	▬	▬	▬

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* Minimum Standard

AREA

ective: Compare as larger or smaller the area of two surfaces.

erial(s): A collection of objects having flat surfaces such as a postage stamp, card, game board, record album, sheet of paper, etc.; tagboard arrow cards labeled "has a larger area than"

ple ivity: The teacher will make a collection of objects that have flat surfaces and have student group the objects into pairs and place an arrow card which reads, "has a larger area than." After the student completes the activity, the teacher will check the work. As a follow-up activity, the teacher will suggest that the student use all of the objects and make a train using the arrow cards. The object at the head end of the train will have the greatest amount of surface while the one at the tail end of the train will have the least amount of surface.

des: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

ective: Order the surfaces of three or more regions.

erial(s): Paper, crayons, scissors, a collection of objects each having at least one flat surface

ple ivity: The teacher will demonstrate how a rubbing may be made by placing a piece of paper over an object that has a flat surface and rubbing the surface of the paper with a crayon. The teacher will have student make a collection of objects that can be used for a rubbing such as cardboard animals or dolls, leaves, plastic geometric shapes, scissors, etc. After the rubbings are made, ask each student to order his rubbings on a bulletin board from the shape that encloses the least amount of surface to the shape that encloses the most.

des: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

ective: Use non-standard units (dominoes, counters, markers, etc.) to cover an irregular region.

erial(s): Cookie cutters or other objects to trace, lima beans or other units to glue on, tagboard, felt-tip pins, record sheet, pencils

Sample Activity: The teacher will give students a box that contains cookie cutters and other shapes which may be traced. Ask each to work with a partner and select a shape to trace. They are to guess and then fill in and count the number of lima beans (or other units) that will fit inside each of the shapes. Have them enter their answers on record sheets like the one below.

Guessed Number of Lima Beans	Shape	Counted Number of Lima Beans
	Heart	
	Circle	
	Tree	
	Pumpkin	

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Objective: Determine the number of non-standard units needed to cover an irregular region.

Material(s): Jump rope, long string or masking tape, carpet tiles, tablet back, etc.

Sample Activity: The teacher will mark off an irregular region on the classroom floor with the jump rope, string or masking tape and have students estimate the number of carpet tiles, tablet backs or other objects needed to cover this space. Students will record their estimates and will actually cover the region in order to check their estimates.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Objective: Make statements describing areas.

Material(s): Glue, construction paper, plastic straws

ample ctivity: Each student will be given three straws and asked to construct geometric shapes by cutting and gluing his straws to a piece of construction paper. Each student will select the geometric shapes of three of his peers and state whether the area of his geometric shape is equal to, larger than, or smaller than his peers'.

rades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

bjective: Use the term "area" to describe the amount of surface of an object.

aterial(s): Classroom objects, various non-standard units (beans, buttons, etc.)

ample ctivity: The teacher will guide the students in verbally describing the areas of various objects in the classroom. Discussion will focus on the following points: (1) objects that have surface areas that are about the same, (2) objects in the classroom that are larger (or smaller) than a given object, (3) description of the surface area in terms of various non-standard units.

rades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

bjective: Estimate the number of non-standard units needed to cover an irregular region.

aterial(s): Dried beans (or buttons, pennies, etc.), activity sheet (or outlines of seasonal pictures)

ample ctivity: The teacher will allow the students to look at each drawing on the activity sheet. Let each estimate the number of beans needed to cover each figure. After estimating, each student will actually place beans in each figure's outline until the surface is covered.

rades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

bjective: Identify the square centimeter as a unit for measuring area.

aterial(s): Poster paper, ruler, scissors, and centimeter graph paper

ample ctivity: The student will measure several one square centimeter regions, draw, and cut them out. Students may then identify other objects about the same size as a square centimeter.

Note: Each square button on a "push button" telephone measures one square centimeter (1 cm^2). Each student can make mosaic pictures using centimeter squares and count and record the number of cm^2 used.

rades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

ojective: Measure, by counting in square centimeters, the area of a region.

aterial(s): Centimeter squares cut out of construction paper

ample ctivity: The student will fill an outline of a square or rectangle using centimeter squares and determine the number of square centimeters needed by counting. He will repeat with a variety of sizes and shapes of rectangles.

Note: Transparencies with centimeter square grids drawn on them can be laid over figures and students can count the cm^2 needed to cover the figure.

rades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

ojective: Estimate the area of a small region in square centimeters.

aterial(s): Construction paper with centimeter grid on it

ample ctivity: The teacher will cut figures from the construction paper. The figures should include straight-sided figures cut to whole centimeter dimensions (example: a rectangle 3 cm wide and 4 cm long) and odd-shaped figures such as cookie cutter shapes. Each figure should be marked on the plain side with a letter (a, b, c) for ease of identification. Student is to look at the plain side of the figure and estimate the number of square centimeters in the area of the figure. Estimates should be recorded. The student will turn the figure over and determine the area by counting the squares and record the findings. (Odd-shaped figures will require approximations.) Students will be given the opportunity to discuss findings.

rades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

ojective: Identify the square decimeter as a unit for measuring area.

aterial(s): Poster paper, ruler, scissors

ample ctivity: Student will measure, draw, and cut out several square decimeters. The student will identify other objects about the same size as a square decimeter.

Note: The bottom of a half-gallon milk carton is approximately one square decimeter. Students will compare the size of the cm^2 and the dm^2.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12. Objective: Measure, by counting in square decimeters, the area of a region.

Material(s): Square decimeters cut out of construction paper or tagboard

Sample Activity: The students will use sample square decimeters to cover books, desk tops, drawings of rectangles, etc. and count to determine the area of the figure.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

13. Objective: Estimate the areas, in square decimeters, of figures larger than a square decimeter.

Material(s): Decimeter squares, record sheet

Sample Activity: Student will estimate the number of square decimeters in each region drawn on a chalkboard, desk top, floor tile, or windowpane. On the record sheet, student will record the estimate. Then, by laying on a dm^2, he will measure the area and record the measurement.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

14. Objective: Identify the square meter as a unit for measuring area.

Material(s): Newspaper, shelf paper or bulletin board paper, at least 4 meter sticks, scissors, tape

Sample Activity: The student will outline a square meter with four meter sticks. The accuracy of the placement should be discussed. Student will construct a square meter out of newspaper, shelf paper, or bulletin board paper. Student will compare m^2, possibly cm^2, with areas of familiar objects.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*15. Objective: Measure, by counting in square meters, the area of a region.

Material(s): Sample square meters made of paper

Sample Activity: Students will use the square meter to determine the area of a chalkboard, a section of the hall, or areas on the playground.

16. Objective: Estimate, in square meters, the areas of regions larger than a square meter.

Material(s): Sample square meters made of paper, record sheets

Sample Activity: Each student will be given a list of regions such as the floor in a classroom, a volleyball court, the stage in the auditorium, etc. Student will estimate each area in m^2, record his estimate, and measure by laying m^2 on the designated area.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

17. Objective: Use the symbol cm^2 for square centimeter, dm^2 for square decimeter, m^2 for square meter.

Material(s): Record sheets for activities similar to those for objectives 9, 10, 13, 15, and 16

Sample Activity: As the students record estimates and measures, they will use the symbols instead of the words written out.

Material(s): Ten cards with names of metric units (familiar to the students) and ten cards with the associated symbols - cm^2 for square centimeter, dm^2 for square decimeter, m^2 for square meter

Sample Activity: Two students will work together and play a Concentration-style game, matching the symbol with the unit name. (See Linear Objective #28.)

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

18. Objective: Demonstrate the relationship of the dm^2 to the m^2; the cm^2 to the dm^2; the cm^2 to the m^2.

Material(s): Samples of centimeter squares, decimeter squares, and meter squares; squares used in previous activities

Sample Activity: The students will show the 10 x 10 relationship (i.e. 100 cm^2=1 dm^2, 100 dm^2=1 m^2; therefore, 10 000 cm^2=1 m^2), by laying on enough sample squares for verification.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*19. Objective: Determine the areas of rectangles (including squares) by multiplying, using the formula A = LxW.

* Minimum Standard

Material(s): Cut outs of centimeter squares, ditto sheets with drawings of various rectangles drawn to centimeter dimensions

Sample Activities: As students experience determining areas by laying on squares and counting, the teacher will help students make the transition to multiplication.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*20. Objective: Determine the area of polygons in metric units using standard formulas - Rectangle: A=LxW, Parallelogram: A-BxH, Triangle: A=½BxH.

Material(s): Grid paper (commercial or teacher-made) or geoboard

Sample Activity: The teacher will have students use grid paper to show that the area of a parallelogram is the same as that of a rectangle with the same height and base, and that the area of a triangle is one-half that of a rectangle or parallelogram with the same height and base. Only metric units of measure will be used in the computation.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

21. Objective: Identify the are (square dekameter), hectare (square hectometer), and square kilometer as metric units for measuring area.

Material(s): Ten meter-lengths of cord or rope, large open area, city map

Sample Activity: The student will use the cord or rope to measure a square dekameter (are) and square hectometer (hectare) in a large open area. He may also use a city map to describe 1 square hectometer (hectare) and 1 square kilometer. Student should relate the size of each unit to areas with which he is familiar - one-half of a volleyball court is about a square dekameter in area, two football fields (side by side) measure about a square hectometer in area. A square kilometer can be identified in relation to the school for verbal identification. (Example: "All the area in the square from the school to Smith's Hardware Store and over to High Street.")

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

22. Objective: Identify the square millimeter as a unit for measuring small areas.

Material(s): Ruler with millimeter markings, paper

nple
tivity:

The student will attempt to draw a square whose area is one square millimeter. He will also attempt to divide a square centimeter region into square millimeters. Student will make a list of common objects which have area of about 1 mm^2.

Note: The purpose of this activity is to help students visualize 1 mm^2.

ades:

K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

jective:

Use the symbols: a for are (pronounced air), ha for hectare, km^2 for square kilometer, mm^2 for square millimeter (also dam^2 for square dekameter and hm^2 for square hectometer).

terial(s):

Student-made maps of school ground with metric dimensions, commercial city or state maps with metric dimensions

mple
tivity:

Student will express various areas on the school ground (front yard, baketball court, etc.) and city and state in appropriate area notations using the symbol for each rather than the full name. Student will use symbols when recording measurements or when making conversions, etc.

ades:

K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

jective:

Choose the most appropriate metric unit for measuring a given surface.

aterial(s):

Textbook, charts, maps, prepared worksheet

ample
ctivity:

Given a list of objects, the student will tell which measure is appropriate:

		(Answers for teacher's use)
Telephone button	= _____	cm^2
Bottom of ½ gal. milk container	= _____	dm^2
Area of floor in room	= _____	m^2
Volleyball court	= _____	dam^2 or a
Area of field	= _____	hm^2 or ha
Area in city	= _____	km^2

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Objective: Determine the area of a circle in metric units using the standard formula $A = \pi r^2$.

Material(s): Textbook and/or teacher-made worksheets

Sample Activity: The students will determine the area of a circle using metric measurement for the radius. (Student will see how close he can come to a "proof" by laying appropriate square units on sample circles.)

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Objective: Determine the surface area of a rectangular prism (cube, box, etc.).

Material(s): Textbook and/or teacher-made worksheets

Sample Activity: The student will use the appropriate formula with metric measurement to determine these areas. (Student will verify findings by "wrapping" the cube, etc. with paper and then opening the paper out flat and determining the area.)

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Objective: Convert square measures within the metric system (e.g., m^2 to cm^2, cm^2 to mm^2, m^2 to mm^2, mm^2 to m^2).

Material(s): Textbook, teacher-made worksheet, metric ruler or tape

Sample Activity: The student will be given a square decimeter region and by measuring each side will determine that 1 dm^2 = 100 cm^2. A square meter area will be marked off and each side will be measured in decimeters to show that 100 dm^2 = 1 m^2. This will show the 10 x 10 relationship.

$$100\ cm^2 = 1\ dm^2$$
$$100\ dm^2 = 1\ m^2$$

Material(s): Prepared worksheet

mum Standard

Sample Activity:	Column A	Column B
	$35\ m^2$	$(350\ 000)\ cm^2$
	$1.37\ mm^2$	$(0.013\ 7)\ cm^2$
	etc	

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

28. Objective: Compute total surface area of any given geometric solid (prism, cylinder, cone, and sphere).

Material(s): Textbook, teacher-made worksheets

Sample Activity: Given a prepared sheet with drawings of geometric solids and appropriate dimensions, the student will compute the total surface area using the appropriate formula.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

29. Objective: Determine the area of a trapezoid using the formula $\frac{1}{2}H(B_1+B_2)$.

Material(s): Prepared worksheet

Sample Activity: Given a prepared sheet with drawings of trapezoids, the student will compute the areas using the formula $A=\frac{1}{2}H(B_1+B_2)$. (Student will verify results by using cut out cm^2 on trapezoids drawn to centimeter dimensions.)

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

CAPACITY AND VOLUME	K	1	2	3	4	5	6	7	8	9	10
(1) Compare amounts of liquid or granular substance in two containers of the same size and shape by using the terms "equal to," "more than," and "less than."											
(2) Directly compare the capacities (volumes) of containers of the same shapes but different volumes.											
(3) Compare the capacities (volumes) of containers of different shapes but of the same volumes.											
(4) Directly compare the capacities (volumes) of containers of different volumes and shapes.											
(5) Order the capacities (volumes) of three or more containers from smallest to largest.											
(6) By counting, determine the volume of a container using non-standard solid units.											
(7) By counting, determine the volume (capacity) of a container using non-standard liquid or granular measure.											
(8) Determine whether a given volume of matter remains the same when the shape of the container is changed.											
(9) Estimate volume (capacity) of a container using non-standard solid, liquid or granular units.											
(10) Construct a solid figure and make appropriate statements about the volume of the figure.											
(11) Identify and use the liter as a standard unit for measuring capacity (volume).											

CAPACITY AND VOLUME

	K	1	2	3	4	5	6	7	8	9	10
(12) Choose a liter container from among a set containing models smaller than 0.5 liter and greater than 1.5 liters.			▬	▬	▬	- -	- -	- -	- -	- -	- -
(13) Determine, to the nearest liter, a given amount of liquid or granular substance.			▬	▬	▬	- -	- -	- -	- -	- -	- -
*(14) Determine, to the nearest liter, the capacity (volume) of a container.			▬	▬	***	- -	- -	- -	- -	- -	- -
(15) Identify and use the milliliter as a standard unit for measuring capacity.				▬	▬	▬	▬	- -	- -	- -	- -
(16) Use the symbol for liter (L) and milliliter (mL).				▬	▬	▬	▬	- -	- -	- -	- -
(17) Use various graduated containers to measure specified amounts in milliliters.				▬	▬	▬	▬	- -	- -	- -	- -
(18) Relate milliliters and liters to familiar measures.				▬	▬	▬	▬	- -	- -	- -	- -
*(19) Add or subtract measurements of capacity (volume) using liters; using milliliters.							▬	▬	▬	▬	***
(20) Estimate capacity (volume) of a container in liters.					▬	▬	▬	- -	- -	- -	- -
(21) Determine, by measuring, the number of milliliters in a liter.					▬	▬	▬	- -	- -	- -	- -
*(22) Choose the appropriate metric unit (liter or milliliter) to determine capacity.					▬	▬	▬	- -	- -	***	- -

* Minimum Standard

CAPACITY AND VOLUME	K	1	2	3	4	5	6	7	8	9	10
(23) Identify the cubic centimeter as a standard unit of volume.											
(24) Determine, by counting, the volume of a container or of a configuration in cubic centimeters.											
(25) Determine the volume of a three dimensional block structure from a pictorial representation of that structure.											
(26) Identify the cubic decimeter as a standard unit of volume.											
(27) Use the symbol dm^3 for cubic decimeter and cm^3 for cubic centimeters of 1000 mL.											
(28) Demonstrate that the cubic decimeter is equal to 1000 cubic centimeters or 1000 mL.											
(29) Demonstrate that the cubic decimeter is the same as one liter.											
(30) Measure capacity (volume) to the nearest milliliter.											
(31) Describe the relationship between counting the units in a model and multiplying the length by width by height to determine volume.											
(32) Identify the cubic meter as a standard unit of volume.											
(33) Use the symbol m3 for cubic meter.											

CAPACITY AND VOLUME	K	1	2	3	4	5	6	7	8	9	10
*(34) Compute the volume of a rectangular solid using the formula - V=lxwxh											***
*(35) Express in liters a measure given in milliliters; in milliliters a measure given in liters.											***
(36) Determine the appropriate metric unit to measure volume (capacity).											
(37) Convert cubic measures within the metric system.											
(38) Use metric units to determine the volume (capacity) of a given geometric solid as appropriate to the grade level (cylinders, cones, spheres).											

1. Objective: Compare amounts of liquid or granular substance in two containers of the same size and shape by using the terms "equal to," "more than" and "less than."

Material(s)" See-through containers, graduated set of metric containers

Sample Activity: The teacher will stimulate students to compare containers by asking, "How many containers can you find that hold more than a saucepan? Draw them and make a chart."

Material(s): A pitcher, a dishpan, tagboard cards with "holds less" printed on them, a collection of containers and water

Sample Activity: The teacher will give a student a water pitcher. The teacher should ask which containers within the collection hold less water than the pitcher. After each measurement, the student will place a "holds less" tagboard card by each container.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

2. Objective: Directly compare the capacities (volumes) of containers of the same shape but different volumes.

Material(s): Graduated sets of containers, a cup

Sample Activity: The teacher will ask students to find the containers in the graduated set which hold less than a cup. Students can record their work by sorting the containers into three groups - those holding less, those holding the same amount and those holding more than the cup.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

3. Objective: Compare the capacities (volumes) of containers of different shapes but of the same size.

Material(s): Set of blocks of a uniform size for individual students

Sample Activity: The teacher will give students an equal number of blocks (perhaps 10 each). Each student is to arrange the blocks in a group. Students will count the number of

different arrangements made. Each student may rearrange his blocks. The teacher may point out new and unusual shapes. Student may try the same activity with other numbers of blocks. He will note that they all have the same volume (number of blocks of equal size) and will keep a record of how many different arrangements were made.

Follow up:

1. Use arrows marked "is equal to" and place same arrangements in the proper places to make true statements.
2. Draw pictures of arrangements of equal volume.
3. Graph number of possible arrangements of volumes of 1 block, 2 blocks, 3 blocks, etc.

Material(s): Collection of boxes with different shapes but equal volume, sand

Sample Activity: The student will fill one box with sand, then pour the sand into another box. The teacher will ask questions such as: Which holds more? How can you tell? Student will arrange the boxes in size order, smallest first. The teacher will explain that the student has been measuring the capacity of the containers and the measured amount is called VOLUME.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

4. Objective: Directly compare tha capacities (volumes) of containers of different volumes and shapes.

Material(s): Set of containers of different volumes and shapes, water, food coloring

Sample Activity: Teacher will color water with food coloring and pour different amounts into see-through containers. Teacher will allow for observation, comparison and pictorial representation. Ask questions such as: Which holds the most water? The least? Which do you think would hold the most-a trash can, a coffee cup, a flower pot? The least?

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

5. Objective: Order the capacities (volumes) of three or more containers from the smallest to largest.

Material(s): Popcorn, dishpan, collection of containers

The teacher will give a group of students five different containers and a bowl of popcorn. The students may arrange the containers from the one that holds the least to the one that holds the most and check the order by pouring popcorn from one container to the next.

Material(s): A collection of cylindrical containers varying in diameter and height, some nuts of the same variety

Sample Activity: The teacher will ask students to work together and order at least five cylindrical containers that vary in diameter and height. When the students have ordered the containers from the one that holds the most to the one that holds the least, the teacher will ask them to check the order by filling the largest container with nuts. Students will remove the nuts from that container to the next largest.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

6. Objective: By counting, determine the volume of a container using non-standard solid units.

Material(s): Milk cartons of various sizes, marshmallows

Sample Activity: Have the student select a milk carton and a supply of marshmallows. Have him fill the carton selected with the marshmallows. Now have him count the marshmallows in the carton. This number is the volume of the milk carton measured in marshmallows. Other Variations: Count how many of the following items a milk carton will hold: dog biscuits, bottle caps, golf balls, blocks, etc.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

7. Objective: By counting, determine the volume (capacity) of a container using non-standard liquid or granular units.

Material(s): Salt, water or sand, thimble(s), assorted containers

Sample Activity: The teacher will have each student select a container, a thimble and an available liquid or granular substance and count the number of thimblesful required to fill the container and compare the capacity of the container with those of other students. Students will compare the capacities of their containers in thimbles.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

8. Objective: Determine whether a given volume of matter remains the same when the shape of the container is changed.

Material(s): Several containers of the same volume but of different shapes, a supply of liquid or granular substances (water, punch, salt, sand, etc.)

Sample Activity: Students working in pairs or groups of three will select three of the different shaped containers. Each group will fill one of the containers with one of the substances provided. They should then pour the substance from one container to another and record what happens to the volume of the original substance as they pour it from one container to the next. They should discover the fact that changing the shape of a given substance does not change its volume.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

9. Objective: Estimate the volume (capacity) of a container using non-standard solid, liquid or granular units.

Material(s): Geoblocks, labels, felt tip pens, record or activity sheets, pencils

Sample Activity: Teacher will select a number of Geoblock structures which may be easily duplicated from smaller cubes and label the blocks selected with numbers or letters. Tell the students that they are to estimate the number of cubes in each block; then construct the block with smaller cubes to check their estimates. Have the students write their estimates and measures on record sheets or activity sheets like the one shown below.

Structure	Guessed Volume in Cubes	Measured Volume in Cubes
1		
2		
3		
4		
5		

Sample Activity: Teacher will collect a set of at least five plastic containers, shampoo bottles, liquid detergent bottles, etc. Select one of the screw-top bottle caps as the unit of capacity. Using the cap as the unit of capacity, ask the students to estimate and then measure the capacity of each container. Students will record their estimates as they compare.

Container	Guessed Number of Bottle Caps	Counted Number of Bottle Caps
Shampoo bottle		
Detergent bottle		
Starch bottle		
Juice bottle		

Material(s): Geoblocks, labels, felt tip pens, record sheets and pencils

Sample Activity: The teacher will select a number of Geoblock structures which may be easily duplicated from smaller cube-shaped blocks. Each block structure should be labeled with a letter of the alphabet. The student will estimate the number of cubes in each structure and duplicate the structure with smaller cubes to check the estimates. Students will record estimates and measures on record sheet.

Structure	Guessed Volume in Cubes	Measured Volume in Cubes
A		
B		
C		
D		
E		
F		
G		

The teacher will observe the students as they do this activity. If, after a few tries, the students are unable to give reasonable estimates of the volume, the teacher should direct them to an activity with a different quantity of measure. The inability to estimate volume is not unusual for students in the primary grades.

Material(s): Liter soft drink bottles, four plastic glasses of different sizes and shapes, water container, felt tip pens and record sheets

Sample Activity: The teacher will direct students to fill the liter soft drink bottles with water and to estimate the number of glasses each bottle holds before measuring. The students will record their estimates and measures on record sheets like the one below.

	Guessed Number of Glasses	Measured Number of Glasses
Small Glasses		
Medium Glasses		
Large Glasses		
Champagne Glasses		

Students will repeat this activity with different sized containers until they are able to estimate, with reasonable accuracy, the capacity of a container.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

10. Objective: Construct a solid figure and make appropriate statements about the volume of the figure.

Material(s): Alphabet blocks

Sample Activity: The teacher will have each student select a definite number of blocks. Student will be instructed to construct a figure using all of the blocks. Each will then label the figure with a numeral or letter and determine, by counting, the volume of the figure in blocks. He will record the volume of his figure next to the figure's name. The student will proceed to construct other figures using some or all of the blocks in his possession to label the figure and to determine and record the volume. The teacher will ask students to share information about the figures they constructed.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

11. Objective: Identify and use the liter as a standard unit for measuring capacity (volume).

Material(s): Liter container, waste paper basket, coffee can, bucket, etc.

Sample Activity: Have the students, working in small groups, use the liter container to fill the various containers. Have them first estimate, then measure and record their findings.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12. Objective: Choose a liter container from among a set containing models smaller than 0.5 liters and greater than 1.5 liters.

Material(s): Standard graduated containers such as beakers or cylinders, assortment of containers of different sizes, water and sand or salt

Sample Activity: The teacher will have the students, working in small groups, choose at least five of the containers and separate them into three groups:

1. Less than one liter
2. About one liter
3. More than one liter

The students will be directed to use the liter beaker or cylinder to check their groupings.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

13. Objective: Determine to the nearest liter a given amount of liquid or granular substance.

Material(s): A collection of containers, liter pitchers, water, record sheet, pencils

Sample Activity: Teacher will demonstrate how this activity may be done. Select an irregular shaped container and fill it with water. Ask students to guess the number of times the container will fill a liter container. After the activity is demonstrated provide each student with a record or activity sheet like the following on which to estimate and measure the capacities of various containers.

Container	Guessed Capacity The Nearest Liter	Measured Capacity The Nearest Liter
1		
2		
3		
4		
5		
6		
7		
8		

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*14. Objective: Determine to the nearest liter the capacity (volume) of a container.

Material(s): Liter cube, an assortment of household containers, water, coffee can, record sheets, pencil

Sample Activity: Ask each student to measure the capacities of some common containers found in the home and decide which containers have a capacity of about 1 liter. He should use a record sheet like the following.

* Minimum Standard

Container	Less Than One Liter	About One Liter	More Than One Liter
Coffee Can			
Soup Can			
Sauce Can			
Plastic Ice Bucket			
Water Pitcher			
Mixing Bowl			
Large Soft Drink Bottle			

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

15. Objective: Identify and use the milliliter as a standard unit for measuring capacity.

Material(s): Standard medicine dropper, colored water, containers (small bottles, spoons, thimbles, etc.)

Sample Activity: Measure various amounts of colored water, noting the capacity of the container in milliliters. Note: A medicine dropper will hold approximately 1 milliliter of liquid.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

16. Objective: Use the symbols for liter (L) and milliliter (mL).

Material(s): Assortment of tin cans (some very large, some very small), graduated cylinders, liter container, water or sand

Sample Activity: Students will work in pairs or small groups to estimate the capacities of the various cans and then check the estimates by either filling each can and measuring its contents with the cylinders or liter containers or filling the can using the cylinder

or liter container to do so. The student should be directed to record his estimate and verification on a chart and to utilize the symbols L for liter and mL for milliliter in doing so.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

17. Objective: Use various graduated containers to measure specified amounts in milliliters.

Material(s): 50-milliliter measuring cylinder, funnel, plastic or waxed paper cup, felt-tipped marking pen, plastic ruler, water (about 500 milliliters)

Sample Activity: The student will use the ruler and pen to draw a line straight down the side of the glass. After allowing the line to dry for a minute or two, he will use the funnel to pour 25 milliliters of colored water into the 50 milliliter measuring cylinder and then into the glass. The student will mark the height of the water on the side of the glass and write "25" (for 25 milliliters) next to the mark. He will add another 25 milliliters of water to the glass, mark the new water height and label it "50" (for 50 milliliters). He will continue the procedure until the glass is graduated to 250 milliliters.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

18. Objective: Relate milliliters and liters to familiar measures.

Material(s): Measuring teaspoon, measuring tablespoon, measuring cylinder marked in 1-milliliter intervals, small jar filled with salt, paper towel, funnel, plastic ruler

Sample Activity: The student will dip up a heaping teaspoon of salt and, holding the spoon over the paper towel, use the edge of the ruler to scrape off the extra salt (that is, make a level teaspoon of salt). With the help of the funnel he will pour the teaspoon of salt into the cylinder and determine the volume of the salt in milliliters.

The student will put three level teaspoons of salt into the cylinder and determine the volume of three teaspoons of salt.

The student will put ten level teaspoons of salt in the measuring cylinder and determine the volume of ten teaspoons of salt.

The student will put one level tablespoon of salt into the cylinder and determine the volume of a tablespoon of salt.

The student will put three level tablespoons of salt into the measuring cylinder and determine the volume of three tablespoons of salt.

The student will use deductive reasoning to determine the number of teaspoons of salt in a tablespoon of salt.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*19. Objective: Add or subtract measurements of capacity (volume) using liters and milliliters.

Material(s): Pencil, paper

Sample Activity: How big is your name?

1. Teacher will assign each letter of the alphabet a capacity value.
2. Teacher will divide class into two groups.
3. Taking initials of first, middle and last name of each student, teacher will have each student compute his capacity.
4. Teacher will have each group total its capacity.
5. Winner is the team with largest total capacity.

Note: This activity should be preceded by a discussion of what rules to follow when adding different metric units; e.g., liters, milliliters, etc.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

20. Objective: Estimate capacity (volume) of a container in liters.

Material(s): 1-liter beakers, graduated cylinders, assorted common containers (large jars, drink bottles, milk cartons, cake pans, sauce pans, etc.)

Sample Activity: The student will estimate the capacity, to the nearest liter, of each container which has been premarked with a letter. The student will record estimates and use the graduated cylinders to check.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* Minimum Standard

21. Objective: By measuring, determine the number of milliliters in a liter.

Material(s): Graduated liter cylinder marked in milliliters

Sample Activity: Student will gradually fill the container and will note that 1000 mL = 1 L.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*22. Objective: Choose the appropriate metric unit (liter or milliliter) to determine capacity.

Material(s): Teacher-made worksheet

Sample Activity: Student will complete statements as follows:

1. Give me four _____ of coke.
2. Our Moped gas tank holds two _____ of gas.
3. The druggist gave me fifty _____ of medicine.

(Teacher will devise other statements.)

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

23. Objective: Identify the cubic centimeter as a standard unit of volume.

Material(s): Supply of centimeter cubes, activity cards with different shapes drawn with the one centimeter cube design

Sample Activity: The student should have an opportunity to examine each small cube to see that each edge has a length of 1 cm, each face has an area of 1 cm^2, and the volume of the cube is 1 cm^3. Teacher will give each student in the group one card and have him estimate the number of cubic units required to build the shape drawn on the card, make the shape and count the number of units (cubes) used. Then the teacher will have him compare his estimate with the actual results. The number of cm^3 is the volume of the shape.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

24. Objective: Determine, by counting, the volume of a container or of a configuration in cubic centimeters.

* Minimum Standard

Material(s): White cuisenaire rods, centimeter cubes, common containers such as a tall glass, plastic refrigerator containers, cigar box, large match box, small bowl, etc.

Sample Activity: The little white cube has a volume of one milliliter (0.001 of a liter). Students will guess the volume of each container and use the materials given here to determine the approximate volume of the containers.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

25. Objective: Determine the volume of a three dimensional block structure from a picture of that structure.

Material(s): Same as Objective #23

Sample Activity: Same as Objective #23. The teacher will provide enrichment by having the student determine the total surface area of each of the shapes. Then the teacher will have him find the total length of the edges of each shape.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

26. Objective: Identify the cubic decimeter as a standard unit of volume.

Material(s): Heavy cardboard, masking tape

Sample Activity: Provide each student with some heavy cardboard, scissors and masking tape. The cardboard should be 30 cm by 30 cm. From each of the four corners the student will remove a 10-cm square; e.g., a square decimeter (dm^2). The shape of the remainder is a cross. Student will fold to form a box and use masking tape to secure into position. This box is a cubic decimeter. The student will observe that the volume of the box is 10 cm x 10 cm x 10 cm = 1000 cm^2 and that it is the basic unit of capacity called a liter.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

27. Objective: Use the symbols dm^3 for cubic decimeter and cm^3 for cubic centimeter.

Material(s): Pencil, paper, chalk, chalkboard

Sample Activity: Student will use the symbols to label problems.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

28. Objective: Demonstrate that the cubic decimeter is equal to 1000 cubic centimeters or 1000 mL.

Material(s): Cubic decimeter blocks made in #26, centimeter cubes or white cuisenaire rods

Sample Activity: Student will place cubes or rods along each of the three dimensions (length, width, height), and multiply to show the 10 x 10 relationship.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

29. Objective: Demonstrate that the cubic decimeter is the same as one liter.

Material(s): dm^3 blocks made in #26

Sample Activity: Student will fill the dm^3 blocks with sand or line with plastic and fill with water, pour into a liter container and compare. (Amounts should be equal.)

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

30. Objective: Measure capacity (volume) to the nearest milliliter.

Material(s): Instrument graduated in milliliters, small containers (medicine bottles, etc.)

Sample Activity: Measure in milliliters the capacities of several small containers.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

31. Objective: Describe the relationship between counting the units in a model and multiplying the length by width by height to determine volume.

Material(s): Three dimensional drawings

Sample Activity: Student will count units of length, width and height, and show that volume can be determined by multiplication as well as counting.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

32. Objective: Identify the cubic meter as a standard unit of volume.

Material(s): Meter stick, corner braces, tape

Sample Activity: Students will work in groups of three and each group will use the meter sticks and corner braces to build the frame of a "box" which has a volume of one cubic meter. The group will then use the frame to help estimate the volume of the classroom. The teacher should ask questions such as: About how many persons of your size could be squeezed inside your box? What is the approximate volume of your teacher?

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

33. Objective: Use the symbol (m^3) for cubic meter.

Material(s): Reference book, pencil, paper

Sample Activity: Student will look up in a reference book the symbol for cubic meter, then determine various volumes and express these volumes using the m^3 symbol.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

34. Objective: Compute the volume of a rectangular solid using the formula V = lxwxh

Material(s): Textbook

Sample Activity: Student will determine volume using the formula with measurements given in metric units.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*35. Objective: Express in liters a measure given in milliliters; in milliliters a measure given in liters.

Material(s): Textbook or teacher-made charts

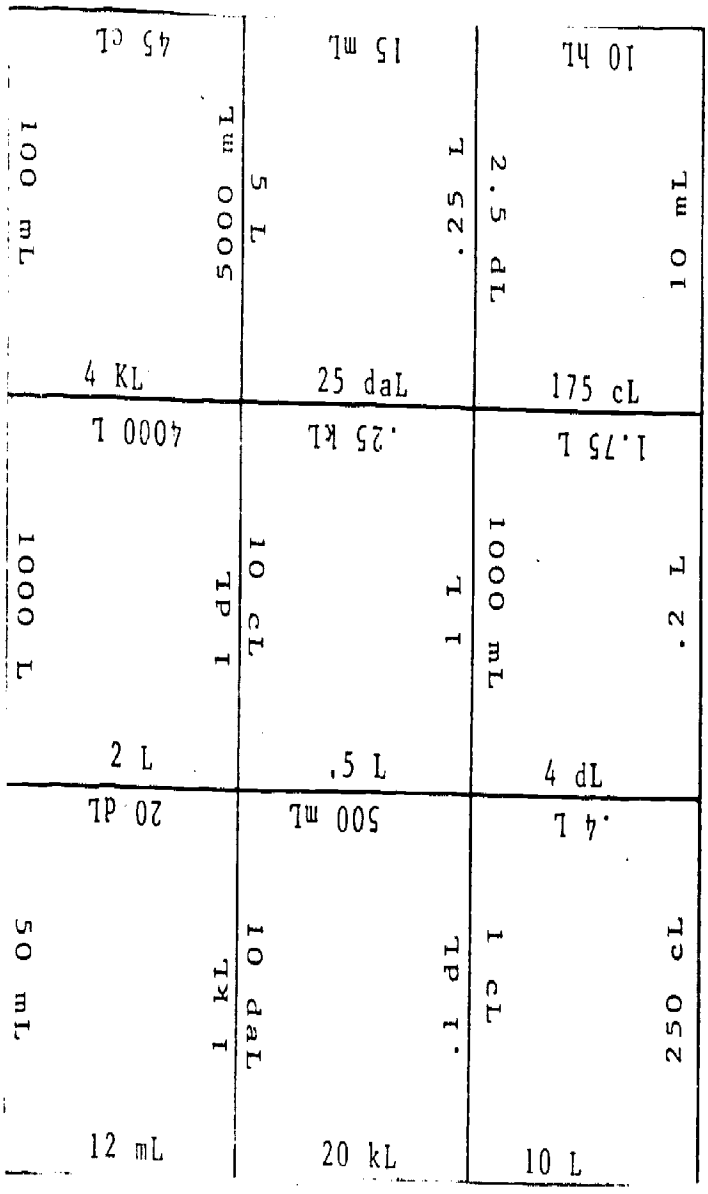
Sample Activity:

1000 mL = 1 L	Answers
1 L = ___ mL	1000
2000 mL = ___ L	2
4500 mL = ___ L	4.5
30 L = ___ mL	30 000

* Minimum Standard

Material(s): Prepared worksheet, scissors

Sample Activity: The objective of this activity is to have the student match equivalent measures to form a square. The worksheet should be designed according to the following figure.



The teacher will ask the student, "Do you know how to match puzzle pieces?" Students should work in pairs to cut the worksheet along the lines, thus dividing the worksheet into nine squares. Each pair should mix up the pieces and then assemble the square by matching equivalent volume and capacity measures. The teacher may have each pair of students paste a picture on the back of the worksheet before cutting it into pieces. Each pair can turn over the completed puzzle to check the answer.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

36. Objective: Determine the appropriate metric unit to measure volume (capacity).

Material(s): Prepared worksheet

Sample Activity: Given various objects, the student will decide what metric unit should be used to measure capacity (volume).

1. Fish tank L (dm^3)
2. Trash container L (dm^3)
3. Washing machine L (dm^3)
4. Swimming pool m^3
5. Medicine bottle mL

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

37. Objective: Convert cubic measures within the metric system.

Material(s): Prepared worksheet

Sample Activity: Given a chart with several cubic metric measures, the student will make the necessary conversions to fill in the blanks.

	m^3	cm^3	mm^3
1.	1		
2.		342	
3.			49872

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

38. Objective: Use metric units to determine the volume (capacity) of a given geometric solid as appropriate to the grade level (cylinders, cones, spheres).

Material: Prepared worksheet

Cylinder: $V = \pi r^2 h$

Cone: $V = 1/3\ \pi r^2 h$

Spheres: $V = \frac{4}{3}\pi r^3$

Sample Activity: Using word problems stating needed metric dimensions, the student will compute the volume (capacity).

Ex.: Compute the volume (capacity) of a cone whose radius is 3 cm and whose height is 12 cm. What is the volume (capacity) of a cylindrical pipe whose radius is 5 cm and whose height is 2 m?

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

WEIGHT AND MASS	K	1	2	3	4	5	6	7	8	9	10
* (1) Identify concrete objects as heavier or lighter.				***							
(2) Distinguish between lighter and heavier objects.											
(3) Using only a balance, order at least three objects from lightest to heaviest.											
(4) Using a balance and non-standard units (paper clips, chips, etc.), determine the masses of many different objects in terms of the non-standard units.											
(5) Determine whether the amount of matter in an object remains the same when the shape of the object is changed.											
(6) Identify and use the gram as a unit of mass.											
* (7) Determine the masses of objects in grams by using a balance and gram masses.						***					
(8) Identify and use the kilogram as a unit of mass.											
* (9) Determine the masses of objects in kilograms.						***					
(10) Construct and use a simple balance for determining mass.											
(11) Estimate and determine the masses of objects to the nearest kilogram.											

nimum Standard

WEIGHT AND MASS	K	1	2	3	4	5	6	7	8	9	10
(12) Estimate and determine the masses of objects to the nearest gram.											
(13) Recognize and use the symbols for kilogram (kg) and gram (g).											
(14) Use a pan balance to determine the number of grams in one kilogram.											
(15) Add and subtract like whole metric units of mass.											
(16) Choose and approximate metric unit (kilogram, gram) to measure the mass of an object.											
*(17) Express in grams the mass of an object given in kilograms. Express in kilograms the mass of an object given in grams.											***
(18) Determine the mass of a substance (object) which must be contained (held) during measurement by subtracting the mass of the container from the combined mass of container and content.											
(19) Identify the milligram as a metric unit of mass.											
(20) Recognize and use the symbol for milligram (mg).											
*(21) Express in milligrams the mass of an object given in grams. Express in grams the mass of an object given in milligrams.											***
(22) Multiply a whole metric unit of mass by a given number. Divide a whole metric unit of mass by a given number.											

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Minimum Standard

WEIGHT AND MASS	K	1	2	3	4	5	6	7	8	9	10
(23) Use decimals to illustrate the relationship among milligrams, centigrams, decigrams, grams, dekagrams, hectograms and kilograms.							▬	▬	▬	- - -	
*(24) Add and subtract masses and convert to units requiring use of decimals.							▬	▬	▬	▬	***
(25) Identify the tonne as a metric unit of mass.							▬	▬	▬	▬	▬
*(26) Determine the most appropriate metric unit to measure mass (milligram, gram, kilogram, tonne).						▬	▬	▬	▬	***	- - -

imum Standard

* 1. Objective: Identify concrete objects as heavier or lighter.

Material(s): Pairs of cans - coffee, soda, etc., materials for filling cans - beans, rocks, popcorn, plastic packing filler, etc., tagboard, strips with the words "lighter" and "heavier" printed on them

Sample Activity: The teacher will fill the like pairs of containers with different materials so that they have different masses. Student will be given filled containers and asked to lift each pair of containers and label the lighter and the heavier one with a tagboard label. The teacher will check the student's work when it is completed.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

2. Objective: Distinguish between lighter and heavier objects.

Material(s): Pictures of familiar objects and animals mounted on cardboard and laminated

Sample Activity: The teacher will cut out about 20 pictures of objects or animals that are familiar to students. For example: cat, dog, bike, ring, giraffe, paper clip, etc. Pictures can be mounted on cardboard and laminated. The teacher will ask a student to divide the pictures into two piles and order each set of pictures from the one which shows the lightest object or animal to the heaviest one.

Material(s): Plastic bottles - 120 mL (4 oz.) size labeled and filled with such things as sand, beans, dirt, paper clips, etc., tagboard cards with "heavier than" and "lighter than" printed on them, record sheets, pencils

Sample Activity: The teacher will fill some plastic bottles with different materials and label the contents of each container. The teacher will ask a student to select one of the containers and set it between the two cards marked "heavier than" and "lighter than." The student can then sort the other containers by comparing them to the container in the middle.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

3. Objective: Using only a balance, order at least three objects from lightest to heaviest.

* Minimum Standard

Material(s): Pan balance(s), group of objects of varying masses - e.g., shoe, pencil, box of chalk, thumb tack, etc.

Sample Activity: The student will compare items in pairs to determine which is heavier. When all comparisons have been made, the student will arrange the items in a line (order them) from heaviest to lightest. Each should be able to prove the arrangement is correct.

Note: After a number of experiences with balances, a similar activity can be done with a board 1.5 to 2 meters long, strong enough to support students and a brick or other device to be used as a fulcrum. The teacher will help students learn how to use a balance board and fulcrum to determine the heavier of two objects. The board should balance when the fulcrum is in the center. This point on the board should be marked so it can be easily located. When the two objects are placed at the ends of the board, the end of the board with the heavier object will sink. Students can then work in groups of three or four, compare their own masses (weights) and arrange themselves in order by mass.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

4. Objective: Using a balance and non-standard units (paper clips, chips, etc.), determine the masses of many different objects in terms of the non-standard units.

Material(s): Set of simple pan balances, 40-50 clothes pins, small articles to be measured (chalkboard eraser, scissors, box of crayons, small blocks)

Sample Activity: Students will use the clothes pins as mass pieces and determine the masses of items. Students should be given the opportunity to make statements about the mass such as, "My scissors have the same mass as 7 clothes pins."

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

5. Objective: Determine whether the amount of matter in an object remains the same when the shape of the object is changed.

Material(s): Pan balance, blunt table knife, modeling clay

Sample Activity: The teacher will give a student a large lump of clay and ask that the clay be rolled into two balls that have the same mass. A pan balance is used to check the masses of the two pieces of clay. When the student is satisfied that there are two pieces of clay with equal masses, the teacher or student will take one of the balls of clay and

mold it into a pancake shape. The teacher may ask the student questions similar to: Is there more, less or the same amount of clay as before? After the response, ask for justification: How do you know? If the student does not realize that the mass has not changed, he should verify it by showing that it balances with the other clay piece.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

6. Objective: Identify and use the gram as a unit of mass.

Material(s): A two-pan balance, 10 one-gram mass pieces, a collection of small objects - paper clips, money, keys, buttons, nails, screws, washers, etc.

Sample Activity: The teacher will give students 10 one-gram mass pieces and a two-pan balance. The teacher will tell them that they are to find as many objects as they can that have a mass of 1, 2, 3, 4, 5 grams. A list of the objects they find can be written on a record sheet.

Mass	Objects
About 1 gram	
About 2 grams	
About 3 grams	
About 4 grams	
About 5 grams	

Material(s): A balance, "centi-cubes" (see note) or mass pieces, a number of small objects such as beans, nickels, pennies, dimes, paper clips, sheets of writing paper, assorted centimeter rods, pieces of chalk, thumbtacks and pins

Note: One-cubic centimeter interlocking cubes (with 1 gram mass) such as "centi cubes" or "cube-o-grams," not wooden cubes

Sample Activity: The teacher will instruct each student to select a group of ten "centi-cubes" or a 10-gram mass piece. Placing the mass piece or "centi-cubes" on one side of the balance, the student is to complete the following:

1. _____ dimes balance ten grams.
2. _____ pins balance ten grams.

The activity should be continued until all possibilities have been explored. Students can use larger mass pieces to repeat the experiment and graph the results.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

7. Objective: Determine the masses of objects in grams by using a balance and gram masses.

Material(s): Balance scale, wooden beads, pine cones, leaves, other common objects, gram masses

Sample Activity: The student will use mass pieces to determine masses of various common objects. The student should estimate the mass of an object before he uses the balance scale.

Note: Measuring ingredients for recipes with dry ingredients given in grams is a meaningful experience. European cooks have long used this more accurate measurement (it yields more dependable results). (See "Metric Fun Cooking Cards" in the bibliography.)

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

8. Objective: Identify and use the kilogram as a unit of mass.

Material(s): A balance scale, mass pieces including kilogram and combinations up to a kilogram, objects to be weighed - blocks, books, a telephone, etc.

Sample Activity: Students will have the opportunity to feel the kilogram mass pieces. They will guess which objects are heavier, lighter or about the same mass as the kilogram. They will then use the balances to verify predictions about mass.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* 9. Objective: Determine the masses of objects in kilograms.

Material(s): A 5 kg spring scale, mesh bag, an assortment of objects such as a book, brick, canned goods, potato, shoe, record sheets, pencils

Sample Activity: The students will use the spring scale to determine which objects in the collection have mass of nearly one kilogram. Have each student enter his findings on a record sheet like the following:

* Minimum Standard

Object	Less than 1 kg	About 1 kg	More than 1 kg
Book Brick Can of fruit Five potatoes Pair of shoes			

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

10. Objective: Construct and use a simple balance for determining mass.

Material(s): Two paper cups, string, coat hanger, mass pieces, common objects

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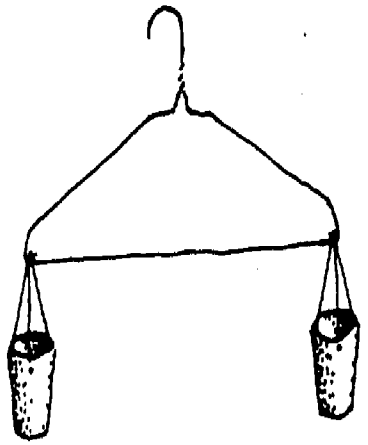
Sample Activity: The student will punch three holes near the top of each cup, spacing them equidistantly. He will then put the strings through the holes and tie. Next, he will hang a cup on each end of the coat hanger. If the scale is unbalanced, he should place a little piece of clay in the appropriate cup. After the balance has reached equilibrium, the student will weigh several common objects.



Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

11. Objective: Estimate and determine the masses of objects to the nearest kilogram.

Material(s): 5-kg spring scale, an assortment of objects, such as a rock, book, shoe, record sheet shown below

Sample Activity: The teacher will have the student estimate the mass of each object to the nearest kilogram. He uses the scale to determine the actual mass. The teacher will have the student record his data on the record sheet by placing check marks in appropriate columns for his estimation and recording measurement findings.

Object	Estimated Mass			Actual Mass
	Less than 1 kg	About 1 kg	More than 1 kg	
book				
rock				
shoe				

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12. Objective: Estimate and determine the masses of objects to the nearest gram.

Material(s): Balance scale (see Objective #10 for simple, inexpensive balances), 5 to 10 one-gram mass pieces, a collection of small objects such as paper clips, keys, buttons and a record sheet as the following

Sample Activity: The teacher will have student estimate the mass of each small object and record the estimate on the record sheet. The student will measure the mass of each object by balancing it with the required number of one-gram mass pieces. The student will record the mass as measured.

Object	Estimated Mass (g)	Actual Mass (g)
Paper clip		
Key		
5 buttons		
Short pencil		

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

13. Objective: Recognize and use the symbols for kilogram (kg) and gram (g).

Material(s): Chart for recording findings

Sample Activity: The student will collect labels from grocery items and make a list of objects written in kilograms (kg).

Sample Activity: The student will collect labels from grocery items and make a list of objects written in grams (g).

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

14. Objective: Use a pan balance to determine the number of grams in one kilogram.

Material(s): A kilogram mass, several 100-g masses and a pan balance

Sample Activity: The student will place the kilogram mass in one pan and balance it by placing 100-g masses in the other pan and use the result to determine the number of grams needed to balance the 1-kg mass.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Note: Objective #17 will extend this activity.

15. Objective: Add and subtract like whole metric units of mass.

Material(s): Simple balances (see Objective #10) or pan balances, 30 to 40 cards with problems on front (see samples) and answers on back

Samples:	5 g	9 g	8 kg	12 kg
	+ 2 g	- 4 g	+ 7 kg	- 4 kg
	———	———	———	———

Sample Activity: Students work in pairs. Cards are placed face up in a stack. The first player draws a card, reads the problem and answers it. He checks the answer on the back. If it is correct he places the card in one side of the balance. The other player takes a turn and uses the other side of the balance for his card. If the player gives the wrong answer, the card is placed under the stack. When all cards have been used, the player having the "heavier" score is the winner.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

16. Objective: Choose an appropriate metric unit (kilogram, gram) to measure the mass of an object.

Material(s): A pan balance, various relatively heavy objects and various relatively light objects

Sample Activity: The teacher will have students use one-gram mass pieces to weigh the heavier objects and kilogram masses to weigh the lighter objects, discovering how impractical it is to measure "heavy" objects with gram masses and that "lighter" objects (with mass of less than one kilogram) cannot be measured with kilogram masses.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

17. Objective: Express in grams the mass of an object given in kilograms. Express in kilograms the mass of an object given in grams.

Material(s): A pan balance, four 1-kg masses, several 100-g masses and two or three 500-g masses

Sample Activity: The teacher will first review the activity for Objective #14. The teacher will then have student balance two, three and four 1-kg masses with 100-g and 500-g masses. The teacher will have student reverse the procedure and develop a table similar to the following:

1 kg = 1000 g
2 kg = 2000 g
3 kg = 3000 g
4 kg = 4000 g
2000 g = 2 kg
3000 g = 3 kg
4000 g = 4 kg

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

18. Objective: Determine the mass of substances (or objects) which must be contained (or held) during measurement by subtracting the mass of the container from the combined mass of container and content.

Material(s): A pan balance, numbered containers, water, rocks, sand and a record sheet

Sample Activity: The teacher will have student measure the mass of a container, place a material in the container and measure the new mass. The teacher will have the student determine the mass of the material by subtracting the mass of the container from the mass of the container and material. Student will record results.

Container	Mass of Container	Mass of Container and Material	Mass of Material
# 1			
# 2			
# 3			
# 4			

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

19. Objective: Identify the milligram as a metric unit of mass.

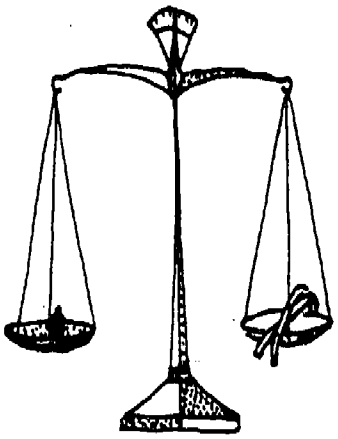
Material(s): Pan balances, potato chips (uniform ones like Pringles or Planters work best), packets of Sweet-n-Low, one-gram mass pieces

Sample Activity: The teacher will have student determine the number of potato chips in 5 grams and in 1 gram. He will then discuss the concept of milli - as 0.001 x a given unit. Students can discuss how big a milligram of potato chips would be.

Note: A raisin is about 1 gram in mass; so 0.001 of a raisin could also be discussed.

Material(s): Pan balances, paper with centimeter grid, scissors, one-gram mass pieces

Sample Activity: Student will cut a strip of cm grid paper 10 cm wide and the length of the ditto paper. He will then balance the paper with a one-gram mass piece. The paper will be too heavy, so student will cut off little strips of paper (keeping the 10 cm dimension intact).



When the paper balances 1 gram, student can cut lengthwise on the cm markings. Each strip will have a mass of 0.1 gram (can be called a decigram). Student can use these strips for balancing if his pan balances are that sensitive. In any case, this activity will help him develop the concept of units smaller than a gram.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

20. Objective: Recognize and use the symbol for milligram (mg).

Material(s): 10 cards with unit names (include milligram), cards with coordinating symbols (include milligram)

Sample Activity: Students work in pairs and play a Concentration-style game, matching unit names with symbols.

Note: See Length and Distance Objective #28 for description of Concentration-style game.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*21. Objective: Express in milligrams the mass of an object given in grams. Express in grams the mass of an object given in milligrams.

Material(s): 15 cards with masses expressed in grams, 15 cards with equivalent masses expressed in milligrams, one card with a picture of a broken set of scales (this could be called "Sagging Scales")

Sample Activity: Students work in groups of 2 or 3 and play a game like "Old Maid." The idea is to make pairs of equivalent masses. The player left with the "Sagging Scales" card is the loser.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

22. Objective: Multiply and divide using whole metric units of mass.

Material(s): Teacher-made worksheets containing appropriate problems

Sample Activity: Samples 5 g x 3 | 6 mg x 5 | 13 kg x 3 | $4\overline{)24\text{ g}}$ | $5\text{ kg}\overline{)15\text{ kg}}$ | $3\text{ mg}\overline{)12\text{ mg}}$

Note: The technique used in Objective #15 may be applied to this activity to create more interest and immediate feedback.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* Minimum Standard

23. Objective: Use decimals to illustrate the relationship among milligrams, centigrams, decigrams, grams, dekagrams, hectograms and kilograms.

Material(s): Commercial or teacher-made charts

Sample Activity: With the teacher's help, the student will construct a chart similar to the following:

0.001 g = 1 mg
0.01 g = 1 cg
0.1 g = 1 dg
1.0 g = 1 g
10 g = 1 dag
100 g = 1 hg
1000 g = 1 kg

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*24. Objective: Add and subtract masses and convert to units requiring use of decimals.

Material(s): The chart from the previous objective and teacher-made worksheet containing problems similar to the following activity

Sample Activity:

4342 mg	5647 mg	745 g
+2416 mg	-2477 mg	+837 g
6758 mg = 6.758 g	3170 mg = 3.170 g	1582 g = 1.582 kg

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

25. Objective: Identify the tonne as a metric unit of mass.

Material(s): Chart used for the two previous objectives

Sample Activity: Teacher will help student add this information to the chart described in Objective #23:
1000 kg = 1 metric ton (t) = 1 megagram (Mg).
Conversions, use of symbols, problems can all be explored with these units.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* Minimum Standard

jective: Determine the most appropriate metric unit to measure mass (milligram, gram, kilogram, tonne).

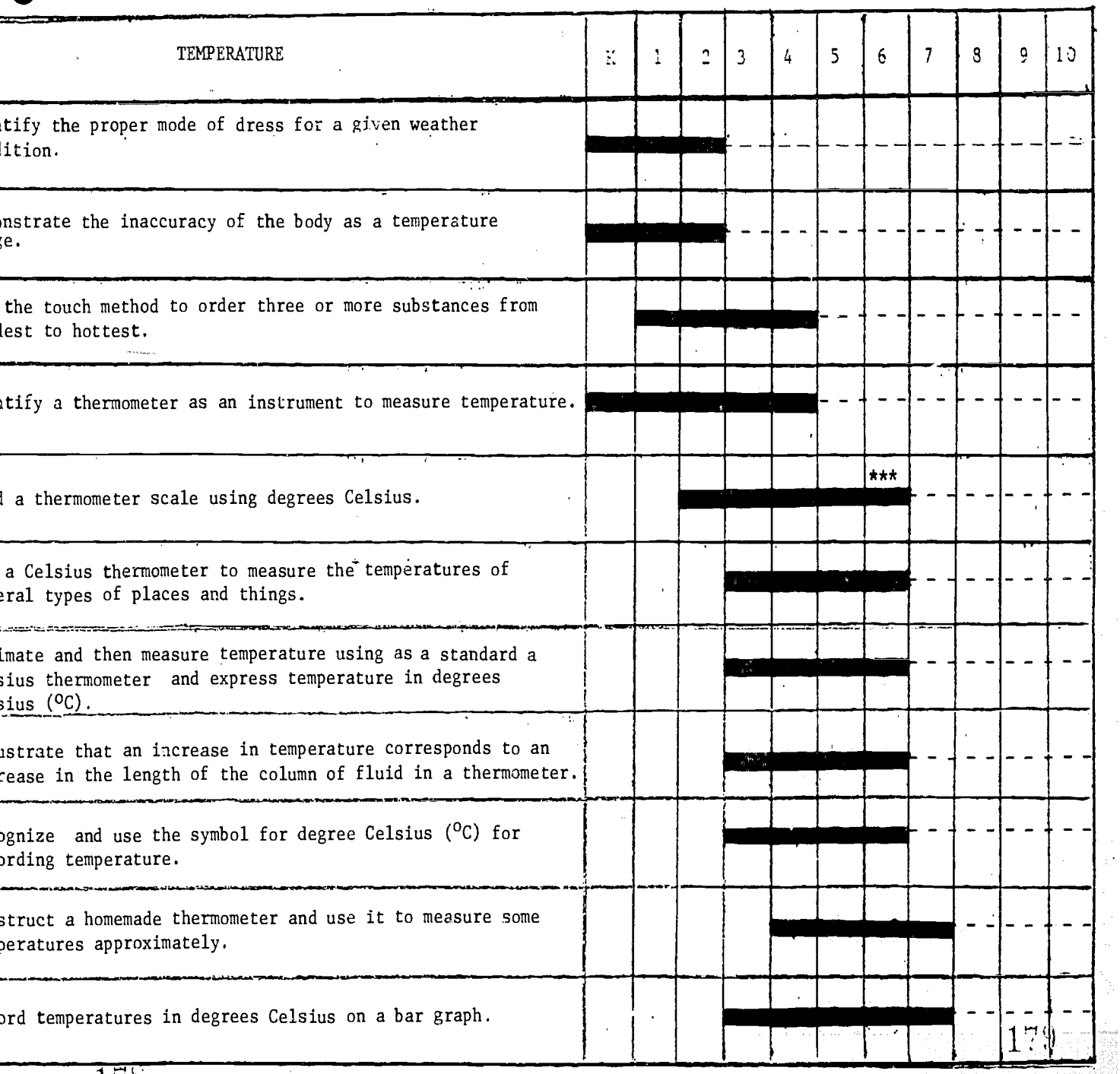
terial(s): Teacher worksheet

mple tivity:

Samples:		Answers:
1.	The load of gravel weights 1 _____.	metric
2.	John weighs 42 _____.	kilograms
3.	The bag holds about 2.5 _____ of sugar.	kilograms
4.	A nickel weighs 5 _____.	grams
5.	One grain of salt weighs about 1 _____.	milligram

ades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

um Standard


TEMPERATURE
K
1
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10
tify the proper mode of dress for a given weather dition.
nstrate the inaccuracy of the body as a temperature ge.
the touch method to order three or more substances from lest to hottest.
tify a thermometer as an instrument to measure temperature.
*** a thermometer scale using degrees Celsius.
a Celsius thermometer to measure the temperatures of eral types of places and things.
imate and then measure temperature using as a standard a sius thermometer and express temperature in degrees sius (°C).
ustrate that an increase in temperature corresponds to an rease in the length of the column of fluid in a thermometer.
ognize and use the symbol for degree Celsius (°C) for ording temperature.
struct a homemade thermometer and use it to measure some peratures approximately.
ord temperatures in degrees Celsius on a bar graph.

TEMPERATURE	K	1	2	3	4	5	6	7	8	9	10
(12) Estimate in degrees Celsius, with reasonable accuracy, temperatures in everyday situations.						■	■	■	■	- -	- -
(13) Determine the change in temperature between two (2) readings in degrees Celsius (^{o}C).						■	■	■	■	- -	- -
(14) Determine the temperature in degrees Celsius from a first reading and a change in temperature.						■	■	■	■	- -	- -
(15) Select the appropriate type of thermometer for measuring temperatures for various phenomena.							■	■	■	- -	- -
(16) Construct a Celsius temperature scale (0 ^{o}C to 100 ^{o}C) ten centimeters in length and on it record various familiar temperatures.							■	■	■	- -	- -
(17) Use an unmarked thermometer to locate the freezing and boiling points of water as reference points and develop the Celsius temperature scale in multiples of 10 ^{o}C.							■	■	■	- -	- -
(18) Compare the Kelvin temperature scale and the Celsius temperature scale by identifying freezing and boiling temperatures of water.								■	■	■	■
(19) Use the symbol K for kelvin.								■	■	■	■

TEMPERATURE

1. Objective: Identify the proper mode of dress for a given weather condition.

   Material(s): A series of pictures depicting the four seasons

   Sample Activity: The teacher discusses with students the fact that as the seasons change, our manner of dress should also change. Showing a variety of pictures, the teacher might ask, "What kind of clothing would you wear for weather like this?"

   Sample Activity: Magazine pictures depicting the types of dress worn during the four seasons - hot, warm, cool, and cold are to be chosen by the students. The pictures should be placed according to appropriate categories, on classroom charts or posters.

   Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

2. Objective: Demonstrate the inaccuracy of the body as a temperature gauge.

   Material(s): Three pans of water: one cold, one lukewarm and one as hot as the hand can stand comfortably

   Sample Activity: Each student will place one hand in the cold water and the other hand in the hot water for about one minute. Then he or she will put both hands in the lukewarm water and describe the feeling. The following questions may be discussed by the teacher and the students: Can you really tell when it is hot or cold? Does being hot or cold make temperature change more noticeable? Change the temperature of the lukewarm water and note the difference in feeling.

   Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

3. Objective: Using the touch method, order three or more substances from coldest to hottest.

   Material(s): Three similar containers, hot water, warm water, and ice water

   Sample Activity: The teacher will help students fill one container with warm water, one container with hot water, and one container with ice water. Each student places two fingers in each container. According to the feel, the students arrange the containers from coldest to hottest. Students will check to see if the order is correct by placing their fingers in each container again. This activity may be varied by having the students order the containers by the feel of the container.

   Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

4. Objective: Identify a thermometer as an instrument to measure the temperature.

Material(s): Celsius thermometers

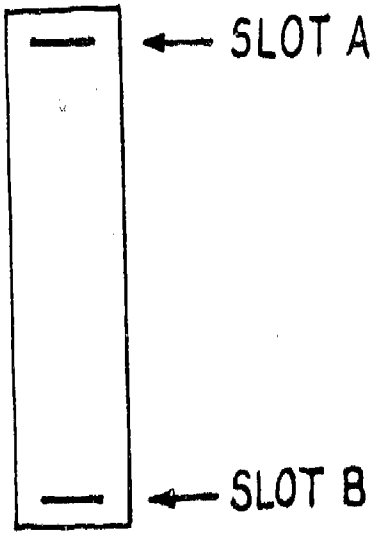
Sample Activity: The teacher will distribute Celsius thermometers. He will explain the calibrations and movement of the liquid in relation to hot, cold, etc. He will direct students to use their thermometers to measure various temperatures. Students will discuss their findings.

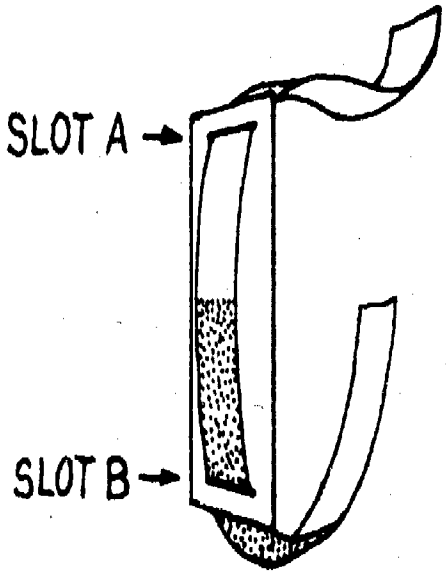
Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* 5. Objective: Read a thermometer scale using degress Celsius (°C).

Material(s): A piece of medium weight cardboard approximately 5 cm wide and 25 cm long for each student, a piece of white ribbon 1 to 2 cm wide and 25 cm long for each student, red colors, pens for marking on the cardboard and a stapler

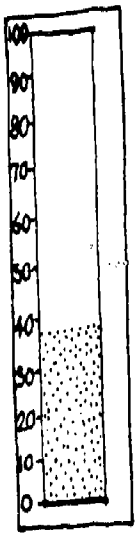
Sample Activity: Each student will construct a model thermometer representing the Celsius scale. The student will use a piece of cardboard approximately 5 cm wide and 15 cm long. Slots wide enough to accommodate the ribbon should be made 10 cm apart near each end of the cardboard as indicated. One half of each piece of ribbon should be colored red. The ribbon should then be threaded through the slots and stapled so it forms a continuous, movable loop.





The ribbon will substitute for the mercury normally found in the thermometers. Each student will mark a scale on his own thermometer. A simple scale using intervals of 10 °C can be drawn by marking intervals one cm apart, with 100 °C by slot A and 0 °C by slot B.

* Minimum Standard



Using this model, students can practice reading the temperature scale ranging from the freezing point of water (0 °C) to the boiling point of water (100 °C). As a temperature is to be indicated, each student will raise or lower the red part of the ribbon to the desired degree Celsius. Students may also work in pairs, setting the ribbon at a certain point and reading the indicated temperatures.

Note: Activities should be adjusted at higher levels to require reading to the nearest degree.

Sample Activity: Use the Celsius thermometer to read and record daily temperatures.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

6. Objective: Use a Celsius thermometer to measure the temperature of several types of places and things.

Material(s): Celsius thermometer, large mixing bowl, hot water and cold tap water, bucket, paper towels, ice cubes

Sample Activity: The student will identify the temperatures of a variety of items. The student will measure the temperature of the classroom, the outside temperature, hot water, cold water, etc. The student should record temperature readings for classroom discussions and/or verification.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

7. Objective: Estimate and then measure temperature using as a standard a Celsius thermometer and express temperature in degrees Celsius (°C).

Material(s): Activity sheet, pencils, and several Celsius thermometers

Sample Activity: The teacher will give each student an activity sheet to serve as a guide. Students will estimate what the temperature will be and then place thermometers as suggested on the activity sheet. Thermometers should be left in position several minutes before readings are made to insure accurate registration of temperatures. Students may need specific instruction as to how to place a thermometer in soil (a pencil should be used to make a hole in the soil to ease insertion of the thermometer).

Activity Sheet

NAME _____

Temperature Readings

Today's temperature (at shoulder level out-of-doors)

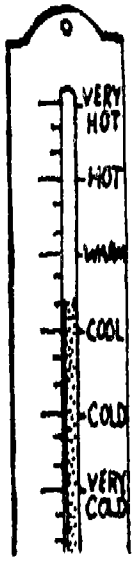
	Your Guess (^{o}C)	Actual (^{o}C) Temperature
On the grass in the sun	- - - - - - - -	- - - - - - - -
On the grass in the shade	- - - - - - - -	- - - - - - - -
Under the grass in the sun	- - - - - - - -	- - - - - - - -
In the soil 1 cm deep	- - - - - - - -	- - - - - - - -
In the soil 3 cm deep	- - - - - - - -	- - - - - - - -
Under the bushes	- - - - - - - -	- - - - - - - -
On the sidewalk in the sun	- - - - - - - -	- - - - - - - -
On the sidewalk in the shade	- - - - - - - -	- - - - - - - -
Soil in pot plants	- - - - - - - -	- - - - - - - -
Classroom closet	- - - - - - - -	- - - - - - - -

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

8. Objective: Illustrate that an increase in temperature corresponds to an increase in the length of the column of fluid in a thermometer.

Material(s): Celsius thermometer, masking tape, water and/or other liquids of varying temperatures

Sample Activity: Each student will tape a strip of masking tape over the scale on the backing of the thermometer. The students will "calibrate" their thermometers according to the following temperature ranges: very cold, cold, cool, warm, hot, very hot.



Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

9. Objective: Recognize and use the symbol for degree Celsius (^{o}C) for recording temperature.

Material(s): Large demonstration model thermometer with numbers appropriate to the Celsius scale, pencil, and paper or record sheets

Sample Activity: The teacher will set the demonstration thermometer at various whole number positions. Each student will read the indicated temperatures and record them on an answer sheet using the ^{o}C symbol.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

10. Objective: Construct a homemade thermometer and use it to measure some temperatures approximately.

Material(s): Glass bottle (such as cold drink bottle), glass tubing or clear soda straw, modeling clay, colored water, marking pen

Sample Activity: Students may work in pairs or singly. Each team will fill the bottle with colored water, insert the glass tubing (or straw), and seal the top of the bottle with clay.

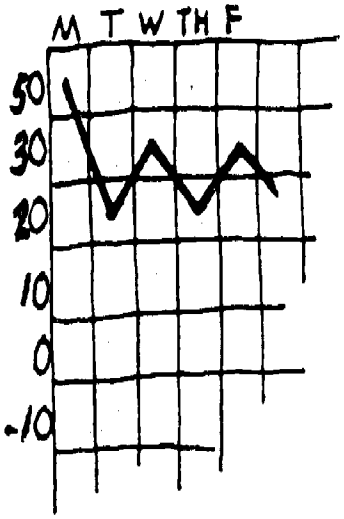
Each team will mark the level of the top of the water in the straw when the bottle is at room temperature, in cold water, warm water, etc.

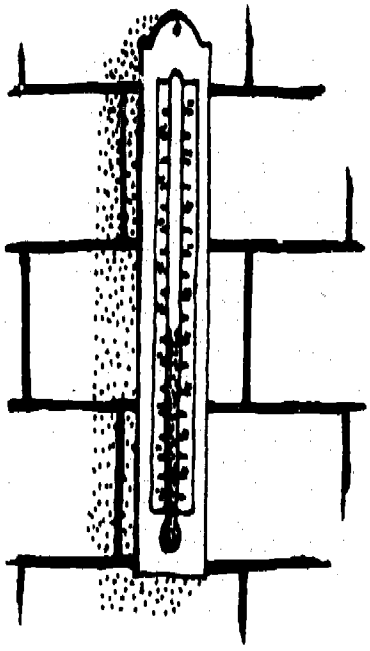
Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

11. Objective: Record temperatures in degrees Celsius on a bar graph.

Material(s): Graph paper or large poster, outdoor Celsius thermometer

Sample Activity: At the same time each day for a week, the teacher will have students determine outside temperature and graph the results either on individual charts or on large classroom charts.





Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

12. Objective: Estimate, in degrees Celsius, with reasonable accuracy temperatures in everyday situations.

Material(s): Textbook or teacher-made worksheet

Sample Activity: Students will estimate the temperatures as listed on worksheet.

Examples: Temperature of a hot summer day
Temperature of a cold winter day
Temperature of cold water from a faucet
Temperature of a cone of ice cream
Temperature of a child with fever
Temperature of a bowl of hot soup

When possible students will be given the opportunity to verify estimates.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

13. Objective: Determine the change in temperature between two (2) readings in degrees Celsius (^{o}C).

Material(s): Teacher-made worksheet

Sample Activity: Each student will complete a chart similar to the following:

First Reading	Second Reading	Change
25 ^{o}C	31 ^{o}C	
65 ^{o}C	36 ^{o}C	
.	.	
.	.	

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

14. Objective: Determine the temperature in degrees Celsius from a first reading and a change in temperature.

Material(s): Teacher-made worksheet

Sample Activity: Students will complete a chart similar to the following:

First Reading	Second Reading	Change
34 ^{o}C		Rise of 6 degrees
18 ^{o}C		Fall of 5 degrees
.		.
.		.

Note: Expand to include negative temperatures according to maturity of students.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

15. Objective: Select the appropriate type of thermometer for measuring temperatures for various phenomena.

Material(s): Various types of thermometers (some stop at 50 ^{o}C, others 100 ^{o}C, etc.) A laboratory type thermometer is preferred.

Sample Activity: Given different situations, such as boiling water, room temperatures, body temperatures, etc., students select the correct thermometer needed to measure same.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

16. Objective: Name the Celsius temperature reading for the boiling and freezing points of water, for comfortable room temperature and for normal body temperature.

Material(s): Loose leaf paper and centimeter ruler

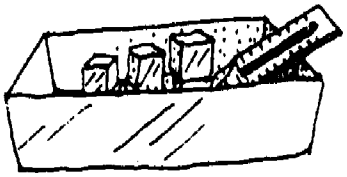
Sample Activity: The student will construct a Celsius temperature scale (0 °C to 100 °C) 10 centimeters long. The student will write in the four temperatures as follows: boiling water, freezing water, room temperature, normal body temperature.

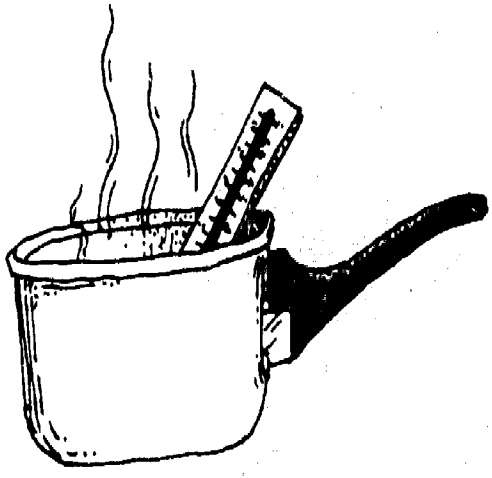
Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

17. Objective: Use an unmarked thermometer to locate the freezing and boiling points of water as reference points and develop the Celsius temperature scale in multiples of 10 °C.

Material(s): Unmarked thermometer, ice cubes, boiling water

Sample Activity: The student will place the unmarked thermometer in a pan of ice cubes and mark the lowest point that the mercury reaches. Next, he will place the thermometer in boiling water and mark the highest point that the mercury reaches. The two points are freezing (0 °C) and boiling (100 °C) on the Celsius scale. The student will subdivide the distance between the two points into 10 equal parts and then into 100 equal parts. (This procedure is called calibrating the thermometer.)





Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

18. Objective: Compare the Kelvin temperature scale and the Celsius temperature scale by identifying freezing and boiling temperatures of water.

Material(s): Prepared worksheet

Sample Activity: Given a sheet with a drawing of a Celsius thermometer and a calibrated Kelvin thermometer, the student will fill in the corresponding temperature on the Celsius thermometer.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

19. Objective: Use the symbol K for the kelvin.

Material(s): Teacher-made worksheet

Sample Activity: Students will restate temperatures given in degrees Celsius to kelvins and record the kelvin temperatures using the symbol K.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

TIME	K	1	2	3	4	5	6	7	8	9	10
* (1) Relate concept of time (morning, noon, night) to events.			***	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
(2) Use the words faster and slower to compare appropriately the rates of activities.				- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
* (3) Name orally the days of the week and months of the year.			***	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
(4) State simple sequences of common activities/events.				- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
(5) Associate specific times with common activities/events.				- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
* (6) Identify the hour and minute hands on the clock.				- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
(7) Recognize differences in the positions of the hands on a clock.				- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
(8) Place the numerals 1 to 12 in the correct places on a clock face.				- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
* (9) Tell time on the hour.			***	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
*(10) Use the calendar to determine the day of the week, the month, and the year of a given date.				***	- - -	- - -	- - -	- - -	- - -	- - -	- - -
*(11) Tell time on the half hour.				***	- - -	- - -	- - -	- - -	- - -	- - -	- - -

inimum Standard

TIME	K	1	2	3	4	5	6	7	8	9	10
(12) Estimate and measure time using a non-standard unit of measure.											
(13) Tell time on the quarter hour.											
*(14) Tell time to the nearest five minute interval.						***					
*(15) Record specific time elements on paper, using colon notation.				***							
(16) Use the term minute to describe appropriately that specific time interval.											
(17) Determine approximately the length of one minute without using a clock.											
*(18) Tell time to the nearest minute (use three different methods)							***				
*(19) Solve word problems involving time in hours only and in minutes only.						***					
*(20) Solve word problems involving time in days, weeks, months, or years (no conversion).						***					
(21) Identify the time several hours before or after the time shown on a given clock.											
(22) Identify the second as the basic metric unit of time.											

TIME	K	1	2	3	4	5	6	7	8	9	10
(23) Change from one clock unit to another (seconds to minutes, hours to minutes, etc.) and one calendar unit to another (days to weeks, years to months, etc.)					■	■	■	■	■	-	-
(24) Read and write specific times using the 24-hour clock; e.g., 1543 for 3:43 P.M.					■	■	■	■	■	-	-
(25) Estimate the number of times a specific task can occur in one hour.						■	■	■	-	-	-
*(26) Compute sums and differences in time problems involving hours and minutes (extend to seconds) with regrouping.							■	■	***	-	-
(27) Compute sums and differences in time problems involving days, weeks, month, and years - with regrouping.							■	■	■	-	-
(28) Solve word problems using time measures including conversions when needed.							■	■	■	■	■
(29) Use the words "clockwise" and "counter-clockwise" to describe movement around a circle.							■	■	■	■	■
(30) Use the formula (d=rt) to determine distance, rate, or time and express the answer in metric units.								■	■	■	■

Minimum Standard

* 1. Objective: Relate concept of time (morning, noon, night) to events.

Material(s): Chalkboard, chalk, paper, pencil

Sample Activity: The teacher will list on the chalkboard a number of activities such as:

a. eating supper
b. sleeping
c. taking a bath
d. watching T. V.
e. getting ready for bed
f. eating breakfast
g. going to school
h. eating lunch
i. lunch recess
j. rest time

Students will be asked to identify which of these usually occur during the evening hours, which usually occur in the morning and which may occur at midday.

Material(s): Chalkboard, chalk, pencil, paper

Sample Activity: The teacher will list on the chalkboard a number of activities such as:

a. eating breakfast
b. eating lunch
c. eating dinner
e. starting school
f. play time
g. naptime
i. bath time
j. sleeping

Students will be asked to identify which of these usually occur during the day. Variation of the activity: The teacher may use pictures of the activities. The students will be asked to identify which of these pictures illustrate activities that usually occur during the day.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

2. Objective: Use the phrases faster than and slower than to compare appropriately the rates of activities.

Material(s): Pencil, list of things to do, objects such as block, puzzles, etc.

Sample Activity: The teacher will give students a duplicated list of available activities from which they can choose. The students will work in pairs. Students will be reminded that (for fairness and accuracy) they must begin at the same time.

* Minimum Standard

1. Tie the laces on your shoes.
   Who was faster? _____
   Who was slower? _____

2. Locate page 58 in the math book.
   Who was faster? _____
   Who was slower? _____

3. Put together a jigsaw puzzle.
   Who was faster? _____
   Who was slower? _____

4. Build a tower with seven blocks.
   Who was faster? _____
   Who was slower? _____

5. Write the numbers 1 through 10.
   Who was faster? _____
   Who was slower? _____

6. Hop 10 times.
   Who was faster? _____
   Who was slower? _____

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* 3. Objective: Name (orally) the days of the week and months of the year.

Material(s): Calendars

Sample Activity: The teacher will motivate the students by having an oral discussion of a special holiday such as Thanksgiving, Christmas, Easter or Yom Kippur. The months in which these holidays occur will be discussed. Records of dates such as the following will be kept:

a. birth dates
b. the passage of time in terms of days, weeks, months and years

* Minimum Standard

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

4. Objective: State simple sequences of common activities/events.

Material(s): Pictures of common events in student's day

Sample Activity: The student will select three pictures from the collection and arrange them in the order they occur in the normal day's activities.

Material(s): Art paper, crayons

Sample Activity: The student will draw pictures showing three things in order he does when he gets ready for bed.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

5. Objective: Associate specific times with common activities/events.

Material(s): No specific material

Sample Activity: The teacher will use every opportunity to develop the idea of descriptors of time. The teacher will begin this activity by discussing with the students the following ideas.

a. The time that the class comes to school in the morning.
b. The lunch period as it separates the morning from the afternoon.
c. The time the class goes home in the afternoon.

Note: The "language of time" will continue as an integral part of all early childhood education. The teacher may discuss with the students ideas other than those listed above. This will be a continuing activity until students are aware of and have internalized descriptors of time.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Material(s): Toy clocks, cardboard clock faces with hands, etc.

Sample Activity: The student will set clock faces for the appropriate hour for common activities/events as the teacher names the activities.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* 6. Objective: Identify the hour and the minute hands on the clock.

Material(s): Multiple pictures of clock faces, various cardboard clocks, various clocks

Sample Activity: The teacher will ask the students to tell the number that the hour and/or minute hand is pointing to at different times of the day. (ex. lunch time, recess time)

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

7. Objective: Recognize differences in the positions of the hands on a clock.

Material(s): Drawing paper, pencil, clock, scissors, etc.

Sample Activity: While some students will not be able to read or to tell time, differences in the position of the hands on a clock can be pointed out. To increase the student abilities, the teacher may:

a. Sketch the hands of a clock positioned at a given time, followed by another sketch approximately an hour later.

b. Place a clock face on the chalkboard and instruct each student to put hands on it using the classroom clock as a point of reference.

c. Draw several clocks with different times and help the students to visualize the change the passage of time makes in the clock face.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

8. Objective: Place the numerals 1 to 12 in the correct places on a clock face.

Material(s): Sample clock, magnetic board, magnet clock face, numerals

Sample Activity: The student will use magnetic pieces to duplicate numeral positions observed on the sample clock with squares or dots to indicate where numbers should go.

Material(s): Blank clock faces, pencils, crayons

* Minimum Standard

Sample Activity: Students will be asked to write specific numbers on the clock faces.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* 9. Objective: Tell time on the hour.

Material(s): Large cardboard clock for teacher, smaller cardboard clocks for students

Sample Activity:

1. The teacher will divide the class into two teams. Each team forms a straight line. The first student in each line is ready to respond to the teacher's command. The teacher calls out a time (Example: 8:00). The first student on each team moves the hands of his paper clock to the correct time. The student who holds up the correct time first wins a point for his team.

2. The students divide into two relay teams as in the above activity. This time the teacher fixes the hands of the clock on a specific time. The first student to say the correct time wins a point for his team.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

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*10. Objective: Use the calendar to determine the day of the week, the month and the year of a given date.

Material(s): Calendars

Sample Activity: Each student will locate his birthday by month and date and tell what day of the week his birthday will fall on. Expand to identify other events, holidays and special occasions.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*11. Objective: Tell time on the half hour.

Material(s): Large cardboard clock for teacher, smaller cardboard clocks for students

Sample Activity: Similar to those for Objective #9 adjusted to fit half-hour notations.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

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* Minimum Standard

12. Objective: Estimate and measure time by using a nonstandard unit of measure.

Material(s): Dishpan, paper cups, clay, record sheets, pencils

Sample Activity: The teacher will ask each student to construct a water clock by making a hole in the bottom of a paper cup and placing a ring of clay in the bottom of the cup to serve as a weight. After the clock has been made, the student will place it in a pan over water to see how long it takes before the cup sinks. The teacher will give the student a record sheet like the one below and ask him to estimate the things he can do before the paper cup sinks. Some students may wish to work together.

Guess	Activity	Actual Measure
	The number of houses you can draw	
	The number of circles you can cut from scrap paper	
	The number of words you can write that begin with the letter "T"	
	The number of towers you can make with a set of blocks	

Material(s): Cone-shaped paper cup, wide-mouth fruit juice jar or other suitable container, sand

Sample Activity: Construct a sand timer:

1. Cut the tip from the paper cup
2. Insert the cup in the top of the jar
3. Fill the cup with sand

The length of time it takes the sand to run through is called sand-timing.

The following are sample ideas to be used with the timer.

A. In one sand-timing can you:

1. Run the length of the gym?
2. Solve 10 addition problems?
3. Write the alphabet?

B. How many sand-timings does it take to:

1. Clean the classroom?
2. Call the roll?
3. Take the lunch count?

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

13. Objective: Tell time on the quarter hour.

Material(s): Clock, paper, scissors

A. To review the concept of one-fourth, the teacher will fold circular regions of paper, or shade one-fourth of a circular region to correspond, for example, to a clock face showing quarter past 12. A demonstration could be designed to illustrate the fact that as the minute hand moves on from one hour to the next, it covers one-fourth of the face on the clock when it reaches three, another quarter when it reaches six, etc. Many activities illustrating the concept "quarter of" can be used.

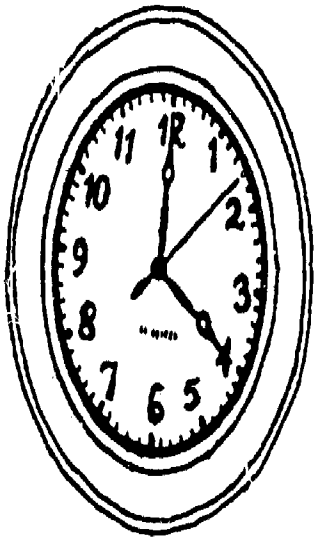
B. Cards with specific times may be made such as:

The student will show on a paper clock face the time indicated on a card. Later, individual students will take turns using the demonstration clock to show the correct times as indicated by the cards. Other students can name the time to verify.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*14. Objective: Tell time to the nearest 5-minute interval.

Material(s): A demonstration clock, transparency of a clock face divided into 12 5-minute intervals. Each minute between each pair of consecutive intervals should be indicated with a dash mark. (See example below.)



Sample Activity: A review of counting by fives may be helpful in preparation for this activity. The teacher will use the transparency of the clock face to help students discover that:

A. There are five spaces between each pair of numerals.

B. The minute hand moves from one numeral to the next in 5 minutes.

Counting by fives should help the students to discover that there are 60 minutes in an hour and 30 minutes in a half-hour.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*15. Objective: Record specific time elements on paper using colon notation.

Material(s): Paper, pencil, clock

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* Minimum Standard

Sample Activity: The teacher will write the following questions on the chalkboard:

1. What time do you go to bed?
2. What time does your favorite T.V. program begin?
3. What time does school begin?
4. What time do we go to lunch?
5. What time does the evening news come on?
6. What time do you go to lunch and recess?

Each student will record the appropriate time for each item. Students will be encouraged to discuss variations in responses.

Material(s): Paper, crayons or felt tip pens, stapler

Sample Activity: Student will make language experience books on time. Each book should be entitled, "What Time Is It?" The student may wish to illustrate the pages in his books and enter the time when he does the things suggested by each caption. The following list includes suggested captions:

1. It is (7) o'clock. It is time (to get up).
2. It is (8) o'clock. It is time (to go to school).
3. It is (12) o'clock. It is time (to have lunch).
4. It is (3) o'clock. It is time (to go home).
5. It is (4) o'clock. It is time (to watch television).
6. It is (6) o'clock. It is time (to eat dinner).
7. It is (9) o'clock. It is time (to go to bed).

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

16. Objective: Use the term minute to describe appropriately that specific time interval.

Material(s): A watch with a second hand, an outside play area

Sample Activity: The teacher will divide the students into groups of five. He will give each group a watch and suggested activities such as:

1. Count the number of times you can hop in one minute.
2. Count the number of times you can sit up in one minute.

One student will keep time as the other students count and participate in the activities.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

17. Objective: Without using a clock, determine approximately the length of one minute.

Material(s): A chalkboard or a clock with a second hand

Sample Activity:

1. The teacher will ask all the students to stand up at a given signal. Each student will continue standing until he thinks a minute has passed. When he does sit down, he will consult the clock to check the appropriateness of his response.

2. The teacher will ask the students to place their heads on their desks and cover their eyes. Without the help of a clock the students will determine approximately the passage of a one-minute interval. When a student thinks the interval has passed, he will raise one arm and check his estimate. Other variations will be used for students who are having comprehension problems.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

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*18. Objective: Tell time to the nearest minute (use three different methods).

Material(s): Clock, paper, several transparencies of clock faces

Sample Activity: The teacher will demonstrate to the students three ways to name the time on a clock face as illustrated below:

For 9:45, one might say -

1. Nine forty-five
2. Forty-five minutes past nine
3. Fifteen minutes (or quarter) to ten

The students will work with their clocks as the teacher demonstrates each time.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* Minimum Standard

*19. Objective: Solve word problems involving time in hours only and in minutes only.

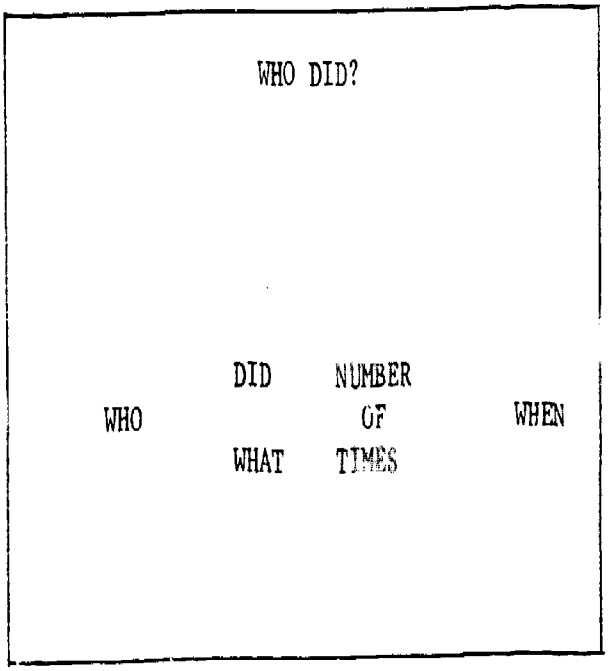
Material(s): A teacher-made gameboard with spaces marked to designate progress, cards with word problems involving time in hours or minutes, markers for players, a die

Sample Activity: The students will work in teams of two to four. In turn, each team will draw a card, read the problem aloud and solve the problem. If the team answers correctly, one member of the team rolls the die and moves the team marker the number of spaces determined by the roll of the die. The winning team is the first one to go around the board.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*20. Objective: Solve word problems involving time in days, weeks, months or years (no conversion).

Material(s): A teacher-made poster with pockets similar to the one below (directions may be written on the bottom)



Five cards for each pocket similar to the following:

WHO cards: Sam, my sister, the boy next door, a man I know, Mrs. Jones

 imum Standard

DID WHAT cards: Worked, rode a bicycle, played a piano, ate an apple, read a book

NUMBER OF TIMES cards: Two times, three times, four times, five times, six times

WHEN cards: Every day for 5 days, every year for 3 years, every week for 4 weeks, every month for 2 months, every day for 6 days

Sample Activity: Each student will work individually. He will select one card from each pocket and copy the information from the cards to make a story problem. A sample story from the suggested cards might be: "The boy next door read a book two times every day for 5 days." The student then writes an appropriate question such as, "How many times did he read a book?" The student then determines the answer to the question.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

21. Objective: Identify the time several hours before or after the time shown on a given clock.

Material(s): Two cardboard clock faces with movable hands, student work sheets each with 12-15 clock faces without hands, a list of 12-15 time problems (see suggestions in activity)

Sample Activity: Each student will be given a work sheet and the two cardboard clock faces will be placed so all students can see them. The teacher will read a time problem such as, "The Green family wants to have dinner at 6:00. (The teacher will set or have a student set one cardboard clock at the stated time.) It takes 2 hours to cook the meal. What time should the cooking be started?"

Each student will draw hands on a clock face on his work sheet to show the answer to the question. The teacher will have one student set the hands on the second cardboard clock face to show the time so other students can check their answers.

Note: First experience with this type of activity should be done with whole-hour moves from times on the hour and later proceed to partial-hour moves from between-the-hour times.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

22. Objective: Identify the second as the basic metric unit of time.

Material(s): A large clock with a sweep second hand

Sample Activity: The students will observe the movement of the second hand for one minute, trying to count to 60, one count per second.

Sample Activity: The students will practice counting seconds as "one thousand-one, one thousand-two..." for 10 seconds at a time until pacing is correct.

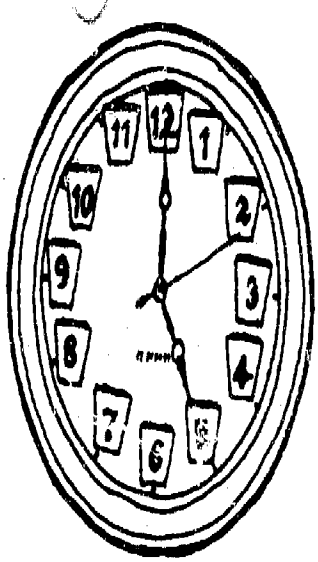
Sample Activity: The student will run in place for 10 seconds, counting steps. Students will determine step rate by dividing the number of steps by 10.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

23. Objective: Change from one size clock unit to another (seconds to minutes, hours to minutes, etc.) and one size calendar unit to another (days to weeks, years to months, etc.).

Material(s): A teacher-made gameboard, cards, an answer key

Directions: Cut a 50-cm circle of cardboard for gameboard. Attach 12 wedge-shaped pockets (see picture). Write the numbers 1-12 around the edge and attach three hands similar to the second, minute, and hour hand on a clock. Design five to eight cards for each pocket on the gameboard. Each card should contain a statement requiring the conversion of one time unit to another. For example, 60 seconds = _____ minutes, 2 years = _____ months, etc. (Statements should be selected according to the mathematical skills of the students.) Write answers to problems on an answer key.



Suggested Activity: Up to three students may play this game. Each one selects a hand for a marker and all markers are turned to 12:00. The first player (the one using the second hand) selects

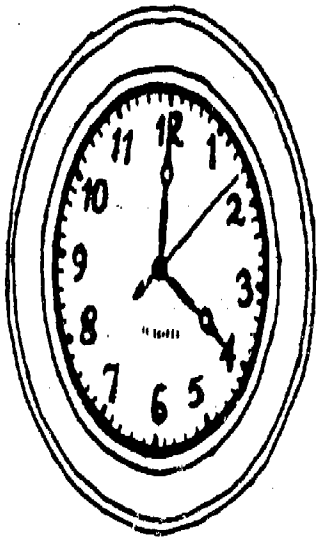
a card from the pocket located between 12 and 1 o'clock. If he can complete the statement correctly, he moves his marker to 1:00. If he cannot answer correctly his marker stays at 12:00 and he must draw from the same pocket on his next turn. Player two (the one using the minute hand as a marker) and player three (the one using the hour hand) play in a similar manner. Player always draws cards from the pocket just ahead of his marker. The first player to return to 12:00 is the winner.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

24. Objective: Read and write specific times using the universal or 24 hour clock.

Material(s): Sample clock face, pencils

Sample Activity: The students will construct their own clocks similar to the one illustrated below:



(The time shown is 0400 if it is night time; 1600 if it is afternoon.)

The students will keep a diary for one week using 24 hour notation.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

25. Objective: Estimate the number of times a specific task can occur in one hour.

Material(s): Pencil, clock, record sheet

Sample Activity: The teacher will select activities students are familiar with such as physical education, lunch, recess, etc. The student will record his estimates of the number of minutes each activity takes; and then, how many can take place in an hour. The student will then actually time the activity by recording the beginning and ending

times and calculating the number of minutes actually taken. The student will calculate the number of activities possible in one hour, record the information on the chart and compare it with his estimates.

Example of record sheet:

Estimate	Activity	Starting Time	Ending Time	Duration	No. of Activities In One Hour

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

*26. Objective: Compute sums and differences in time problems involving hours and minutes (extend to seconds) with regrouping.

Material(s): Two cubes with edges at least 2 cm (Foam rubber can be cut into large cubes with an electric knife. These make very practical playing pieces.)

Sample Activity: Teacher will write a time, in hours and minutes, with blue ink on each face of one cube. These times should be 3 hours or less with between 45 minutes and 59 minutes. (Example: 2 hours, 47 minutes.) On the second cube, he will write times with red ink on each face. These times should be 4 hours or more with between 15 minutes

and 44 minutes. (Example: 4 hours, 22 minutes.) If seconds are to be included, blue cubes should have between 45 seconds and 59 seconds and red cubes should have between 15 seconds and 44 seconds.

Students will roll the cubes, form a subtraction problem by subtracting the blue cube value from the red cube value, and compute the difference.

Example: 4 hrs., 22 min. (red cubes)
- 2 hrs., 47 min. (blue cubes)

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

27. Objective: Compute sums and differences in time problems involving days, weeks, months, and years with regrouping.

Material(s): Teacher-made gameboard on which players can mark progress, markers for three or four players, a spinner with these six categories on it (years and months, years and weeks, years and days, months and weeks, months and days, weeks and days), up to 10 cards with addition or subtraction problems in each category, an answer key for all problems

Note: A problem such as the one below would be in the year and week category.

3 years, 16 weeks
+ 2 years, 43 weeks

Sample Activity: Up to four students may play. In turn each player spins the spinner and draws a card from the stack containing cards for the appropriate category. The student will compute the indicated sum or difference (paper and pencil may be used if desired). The answer is checked with the answer key. If the play is correct, he moves his marker one space on the gameboard. Card will be returned to the bottom of the stack from which it was drawn. The first player to reach the goal on the gameboard is the winner.

Note: A seventh category, days and hours, could be added or substituted.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

28. Objective: Solve word problems using time measures including conversions when needed.

Material(s): Sample airline flight schedules, travel brochures, used time clock punch cards, etc.

Sample Activity: The student will use information given on schedules, brochures, etc. to write word problems. The student will then do the necessary computation(s) to solve the problems.

Note: These problems can be put on file cards for easy exchange among students during other mathematics periods. Solutions may be written on the back, or used as a source for teacher-made worksheets.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

29. Objective: Use the words "clockwise" and "counter-clockwise" to describe movement around a circle.

Material(s): Clock, sundial, a wheel or circular object, a fixed pole to be used for tracking the movement of a shadow

Sample Activity: The student will observe and mark the shadows cast by a pole or sundial, marking the time each shadow was formed. The shadow moves in a clockwise direction during the day. The student will compare these observations with standard clock. The teacher will draw a large circle on the board and ask the students to use the terms "clockwise" and "counter-clockwise" to indicate the direction the teacher is drawing.

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

30. Objective: Use the formula (d=rt) to compute the distance, rate, or time, and express the answer in metric units.

Material(s): Prepared worksheet

Sample Activity: Given word problems, the student will determine the distance, rate, or time, and express the answer in metric units.

Examples:

1. Johnny walked 6 kilometers in 2 hours; compute his rate in km/h.

2. If Mr. Francis drives for 3 hours at a rate of 80 km/h, how far has he driven?

3. A plane leaves town A at 6:00 PM and travels 800 km/h. If the distance from town A to town B is 3200 kilometers, what time will the plane arrive at town B?

Grades: K, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

APPENDICES

EVALUATION

In the process of self-evaluation, each teacher should ask the following questions:

A. Did I prepare adequately for teaching this lesson?

B. Were my objectives consistent with the needs of my students?

C. Were my instructional methods motivational?

D. Was my classroom conducive to learning?

E. Did I achieve my objectives?

Student evaluations should be based on the following criteria:

A. Student interviews

B. Teacher observation

C. Group discussions

D. Individual assignments

E. Teacher-made criteria-referenced tests

Free Metric Materials Available To Teachers*

The following metric materials are available at no cost to teachers upon request from the respective suppliers.

1. Department of the U.S. Army
   Distribution Division
   Fort Sheridan, Illinois 60037
   "Modernized Metric System" Poster (1973)
   Developed by the National Bureau of Standards - suitable for secondary students and adults.

2. Educulture, Inc.
   3184 "J" Airway Avenue
   Costa Mesa, California 92626
   "Think Metric U.S.A. - An Audio-Tutorial Mini Course," 1975
   A sample audio-cassette of selected excerpts and a student instructional manual from their audio-tutorial learning program, "Think Metric U.S.A." - suitable for elementary and secondary students and adults.

3. Federal Reserve Bank of Minneapolis
   Minneapolis, Minnesota 55480
   "The United States and the Metric System," Ninth District Exponent Number 10, 1976
   40-page booklet updates the history of metrication through 1975, reviews the pros and cons of metrication, and offers an examination of some of the problems associated with conversion along with means of relieving those problems - suitable for adult and possibly high school levels. Classroom copies available.

4. Field Enterprises Educational Corporation
   Merchandise Mart Plaza
   Chicago, Illinois 60654
   "Metric System/Weights and Measures"
   Reprint from The World Book Encyclopedia, 1976 sections on the "Metric System" and "Weights and Measures" - 13 pages. (Unfortunately, the articles contain many conversion tables.)

*List prepared by Metric Education Technical Support Program, American Institutes for Research, P. O. Box 1113, Palo Alto, CA 94302

5. J. C. Penney Educational Materials - Write your local store
"Insights Into Consumerism: Moving Toward Metric," 1974 Packet includes:
   (a) Five pamphlets discussing our change-over to metric activities and duplicating or overhead projector materials
   (b) Poster - "The Language of Metric"
   (c) Script for radio/TV - "Moving Toward Metric"

(Because the materials were produced in 1974, information on legislation is not up-to-date. Material discusses only liquid volume and assumes that volume is only measured in litres.)
"The Metric Song" - Filmstrip available on loan for one week.

6. LaPine Scientific Company
Department 05
6001 South Knox Avenue
Chicago, Illinois 60629
Plastic metric ruler
"Metric Handbook," a publication which contains activities and exercises for the classroom.
(We were not able to review this handbook.)

7. National Bureau of Standards
Metric Information Office
Washington, D. C. 20234
"Some References on Metric Information"
Metric packet includes:
   (a) NBS Special Publication 389, "Some References on Metric Information," 1975
   (b) "Brief History of Measurement Systems," 1975 - With a chart of the modernized metric system on the back
   (c) Poster - "All You Will Need to Know About Metric," 1974
   (d) Pocket-sized, plastic metric conversion card
   (e) Chart on metric conversion factors, 1976
   (f) Plastic centimetre/inch rulers
   (g) "Household Weights and Measures," 1975 - Includes information on using the metric system in the kitchen
   (h) "America Joins a Metric World," 1976 - Reprint from Dimensions/NBS

8. Ohaus Scale Corporation
29 Hanover Road
Florham Park, New Jersey 07932
"Recommended Lists of Equipment for Teaching the Metric System of Measurement," 1976
Booklet designed to help you select and use metric tools in grades K-8.
Lists of equipment are arranged grade-by-grade for schools of various sizes and budgets.

9. National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091
"Free Materials for the Teaching of Mathematics," August, 1976, NCTM update and guide to suppliers of math materials.

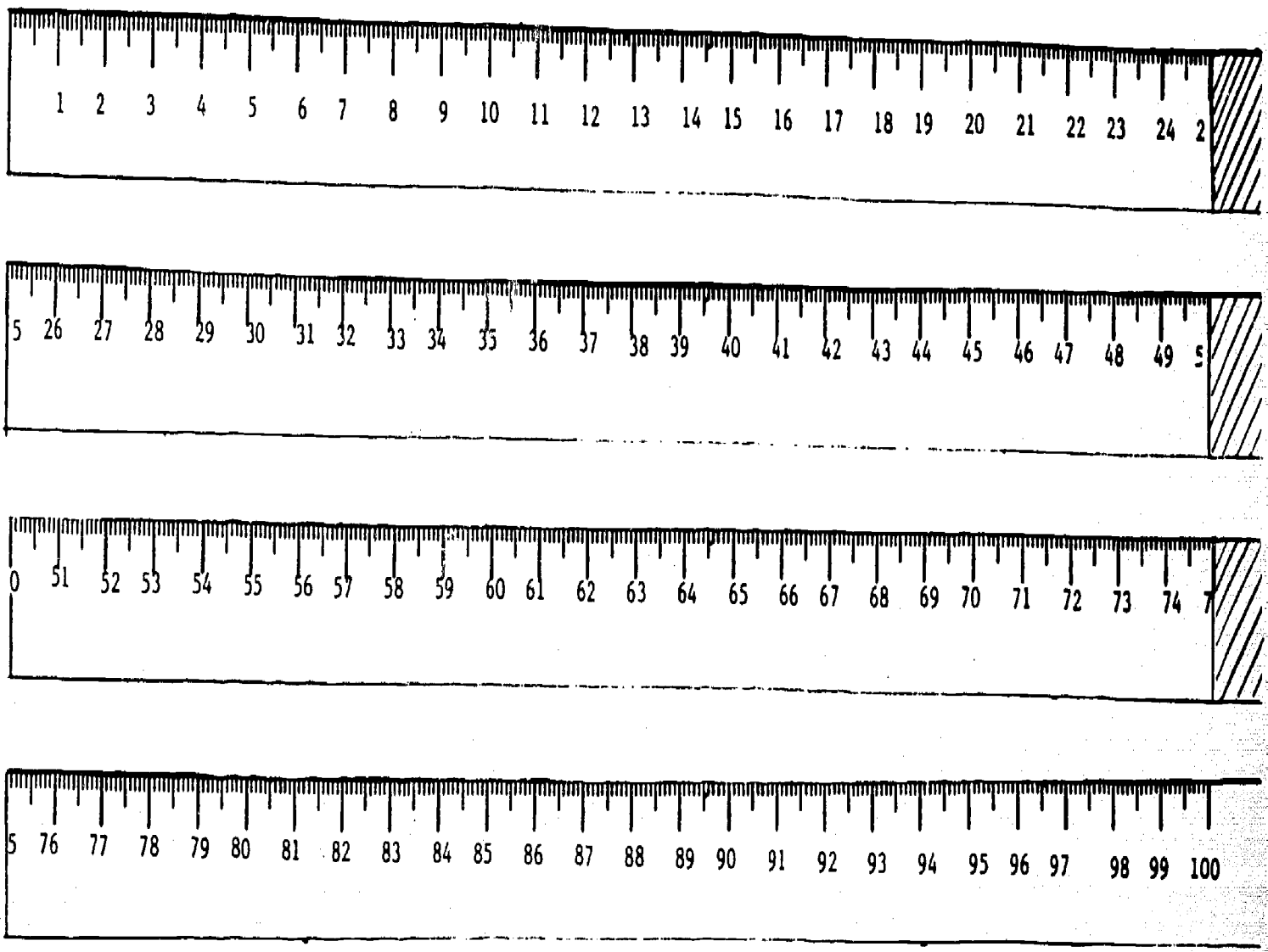
10. Prentice-Hall Media, Inc.
150 White Plains Road
Tarrytown, New York 10591
"When You Can't Give'em An Inch - Metrics Made Easy"
Literature about their metric program which contains a centimetre ruler calibrated in 10 cm units - suitable for bulletin board display.

11. Sears, Roebuck and Company
Consumer Information Service
D/703, Sears Tower
Chicago, Illinois 60684
"An Educator's Guide to Teaching Metrication," 1974
This guide was designed to help secondary teachers incorporate the metric system into different subject areas.

CENTIMETER GR PAPER

METER MEASURE

You can make a meter measure by cutting and assembling the four sections below. Paste together so that the shaded portion of one section is completely covered by the next section.



METRIC PLACE VALUE CHART

	1,000	100	10	1	0.1	0.01	0.001
DECIMAL PLACE VALUE	THOUSANDS	HUNDREDS	TENS	ONES	TENTHS	HUNDREDTHS	THOUSANDTHS
UNITED STATES MONEY	$1,000 BILL	$100 BILL	$10 BILL	$1 BILL	DIME	CENT	MILL
METRIC LENGTH	KILOMETER km	HECTOMETER hm	DEKAMETER dam	METER m	DECIMETER dm	CENTIMETER cm	MILLIMETER mm
METRIC CAPACITY	KILOLITER kL	HECTOLITER hL	DEKALITER daL	LITER L	DECILITER dL	CENTILITER cL	MILLILITER mL
METRIC MASS	KILOGRAM kg	HECTOGRAM hg	DEKAGRAM dag	GRAM g	DECIGRAM dg	CENTIGRAM cg	MILLIGRAM mg

For junior high students: Mega - 1,000,000 x basic unit Micro - 0.000001 x basic unit

SOURCES OF METRIC MAPS

AUSTRIA
Austrian State Tourist Dept.
545 Fifth Avenue
New York, N.Y. 10017
Camping in Austria
(Small guide with campground map)

BELGIUM
Belgian National Tourist Office
720 Fifth Avenue
New York, N.Y. 10019
Camping Belgique-Belgie
(good campground guide)

FRANCE
French Government Tourist Office
610 Fifth Avenue
New York, N.Y. 10020
Go Camping in France
(excellent map with campgrounds)

GERMANY
German National Tourist Office
500 Fifth Avenue
New York, N.Y. 10036
Camping Federal Republic of Germany
(lists many camps, has maps)

CZECHOSLOVAKIA
Cedok-Czechoslovak Travel Bureau
10 East 40 Street
New York, N.Y. 10016
Chalet Camps
Motor Camping in Czechoslovakia
(excellent map with campgrounds located)

DENMARK
Danish National Tourist Office
505 Fifth Avenue
New York, N.Y. 10017
Camping in Denmark
Camping (includes map)

IRELAND
Irish Tourist Board
590 Fifth Avenue
New York, N.Y. 10036
Provinces and Counties
(excellent map)
Caravan and Camping Sites
(good guide)

ITALY
Italian Government Travel Office
630 Fifth Avenue
New York, N.Y. 10020
Guida Camping D'Italia
(thick campground guide)

THE NETHERLANDS
Netherlands National Tourist Office
576 Fifth Avenue
New York, N.Y. 10036
Bungalows, Camping
(good campground guide)

SPAIN
Spanish National Tourist Office
589 Fifth Avenue
New York, N.Y. 10017
Guia de Campings (thick guide)
Mapa de Campings (good map of all campgrounds)

SWEDEN
Swedish National Tourist Office
505 Fifth Avenue
New York, N.Y. 10017
Roads-Youth Hostels-Camping
Tourist Map Camping

SWITZERLAND
Swiss National Tourist Office
608 Fifth Avenue
New York, N.Y. 10020
Camping Holidays in Switzerland
(good map, lists and locates campgrounds)
Switzerland by Car (good itineraries)

AAA
American Automobile Association
World-Wide Travel
1712 G Street, N.W.
Washington, D.C. 20006
Atlas Camping Caravanning
European country maps
European planning maps
Planning guide to Europe
Motoring guide to Europe
Where to stay in Europe
(all of the above available to members only)

KITS

Coronet Instructional Media
65 E. South Water Street
Chicago, Illinois 60601

(1) Liquid Volume
(2) Weight
(3) Temperature
(4) Length and Distance

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BOOKS

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Hiatt, Mary and Linda Harvey. The Metric Mice Measure Weight, The Metric Mice Measure Volume. Englewood, California: Educational Insights, 1974.

Sohns, Marvin L. and Audrey V. Buffington. The Measurement Book. Sunnyvale, California: Enrich, Incorporated, 1977.

Ross, Frank, Jr. The Metric System Measures for All Mankind. New York: S. G. Phillips, 1974.

Youngster, John M. and Davan Dennisp. Meter-Suggested Activities to Motivate the Teaching of the Metric System. P.O. Box 219 Stevensville, Michigan 49127: Educational Services, Inc.